

# THE GENUS *CLUSIA* SECTION *CRIUVA* (CLUSIACEAE) IN GUAYANA

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## ABSTRACT

The genus *Clusia* section *Criuva* is revised for species within the Guayana Floristic Province. Eleven species are recognized, of which five, *Clusia grammadenioides* Pipoly, *C. multilineata* Pipoly, *C. asymmetrica* Pipoly, *C. maguireana* Pipoly, and *C. guayanae* Pipoly are described as new, illustrated, and their phylogenetic relationships are discussed. Amplified descriptions are provided for the section and each hitherto known species, along with keys to the species within the section, and citation of representative specimens. *Clusia reducta* is reduced to synonymy under *Clusia opaca* and *Clusia hexacarpa* subsp. *ptaritepuiana* is reduced to synonymy under *C. hexacarpa*.

## RESUMEN

Se presenta una revisión taxonómica del género *Clusia* sección *Criuva* para las especies procedentes de la Provincia florística Guayanesa. Se reconocen once especies, dentro de las cuales hay cinco, *Clusia grammadenioides* Pipoly, *C. multilineata* Pipoly, *C. asymmetrica* Pipoly, *C. maguireana* Pipoly, y *C. guayanae* Pipoly que se describen como nuevas, se ilustran y se discute su parentesco. Se ofrecen descripciones ampliadas para la sección y especies previamente conocidas; también se presentan claves para identificar las especies dentro de la sección, y un listado de especímenes representativos. Se reduce *Clusia reducta* a la sinonimia bajo *C. opaca* y *C. hexacarpa* subsp. *ptaritepuiana* bajo *C. hexacarpa*.

## INTRODUCTION

While preparing a diagnostic treatment of the genus *Clusia* L. for the *Flora of the Venezuelan Guayana* and a more comprehensive one for *Flora de Colombia*, section *Criuva* was revised. This synopsis treats the species of section *Criuva* indigenous to the Guayana Crystalline Shield (sensu Maguire 1979), and provides descriptions, synonymy, specimen citations distributions, hypotheses of phylogenetic relationships, ecology and conservation status for each Guayana species of the section.

Section *Criuva* is closely related to sections *Stauroclusia* Planch. & Triana

and *Clusiastrum* Planch. & Triana, (Engler 1888, 1893; Vesque 1893), but easily distinguished from both by the staminodes with well-developed anthers, abruptly widened and connivent basally. While Engler (1888, 1893) felt that *Criuva* was most closely related to *Criuvopsis* Planch. & Triana, his classification was based mostly on petal number rather than on some qualitative feature. Pipoly and Graff (1995) have indicated that the most closely related group to section *Criuvopsis* is section *Brachystemon* Engler. Because the formats of the floristic treatments in preparation do not allow for complete descriptions and synonymy, the present treatment is intended to provide data for the Guayana taxa over their entire range, until a more comprehensive revision is prepared.

#### TAXONOMIC TREATMENT

**Clusia** L. section **Criuva** Planch. & Triana, Ann. Sci. Nat. sér 4, 14: 325. 1860.

*Clusia* sect. *Criuva* subsect. *Eucriuva* Engler in Martius, Fl. Bras. 12(1):406. 1888.

*Clusia* subgenus *Criuva* Benth. & Hook. section *Eucriuva* (Planch. & Triana) Engler, Pflanzenfam. 3(6):225. 1895.

Free-standing terrestrial shrubs, trees or hemiepiphytes; latex creamish yellow to translucent, when translucent, oxidizing to yellow. Leaves sessile or petiolate; petioles canaliculate, marginate or trigonal. Inflorescence a terminal pyramidal panicle of cymes, a reduced compound axillary cyme or rarely, a solitary terminal flower, often subtended by foliaceous bracts; secondary inflorescence bracts carnose or cartilaginous; bracteoles 2–4(–14), coriaceous, carnose or cartilaginous. Staminate flowers with spreading perianth; sepals 4–8, coriaceous or chartaceous, the outer opposite, the inner decussate, imbricate or contorted; petals 4–6, coriaceous, carnose or cartilaginous, the outer opposite, the inner decussate, imbricate, or contorted, usually progressively smaller acropetally; androphore rectanguloid, pentagonoid or rarely cubic; stamens numerous, the filaments apically free, connate at the base, fleshy, often thickened at the base; the filaments flat, anthers muticous, rounded or emarginate, equalling or shorter than the filaments, the thecae clavate, oblong or linear, slightly longer than the connective, dehiscent by longitudinal slits; pistillode absent or rarely, vestigial, usually without resin. Pistillate flowers as in staminate; staminodia 4-numerous, free, linear, with vestigial anthers; ovary 4–8 locular, one to multiovulate, ovule placement variable; styles obsolete or equalling locules in number, free, terete or angled, thickened, radiate, stigmas subpeltate, orbicular, ovate, cuneiform or pentagonal. Fruit a dehiscent capsule, ovoid, oblongoid, prismatic or fusiform, stigma and styles persistent.

TYPE SPECIES: *Clusia criuva* Cambessèdes in A. St.-Hilaire, Fl. Bras. Merid. 1:245. 1825.

KEY TO SPECIES OF *CLUSIA* SECTION *CRIUVA*

1. Leaf blades chartaceous to subcoriaceous, dull above, pallid below, the apices acute to acuminate, bearing round, magenta glands abaxially.
  2. Apical portions of branchlets decussately alate; leaves sessile or on broadly marginate; petioles, 0.5–1.0 cm long.
    3. Leaves 1.5–4.0 cm wide, sessile; peduncle 2.0–3.5 cm long; sepal margins opaque; entire ..... 1. *C. duidae*
    3. Leaves 2–6 cm wide, on broadly marginate petioles, 0.5–1 cm long; peduncle obsolete to 3 mm long; sepal margins scarious, hyaline, incised-erose ..... 2. *C. grammadenioides*
  2. Apical portions of branchlets subterete to tetragonal, the corners rounded, not alate; leaves on narrowly marginate or trigonal; petioles 1–3.5 cm long.
    4. Branchlets subterete or weakly tetragonal; leaf blades symmetric, linear latex canals conspicuous; petioles marginate, thin, 1–1.5 cm long; sepals 7, without conspicuous latex canals, the outer sepals acute to acuminate apically; petals decussate, thickly carnose, suborbicular; anthers obovoid ..... 3. *C. multilineata*
    4. Branchlets strongly tetragonal; leaf blades asymmetric, linear latex canals inconspicuous; petioles trigonal, thick, 2–3.5 cm long; sepals 4, linear latex canals conspicuous, the outer sepals rounded apically; petals imbricate, coriaceous, obovate; anthers ovoid ..... 4. *C. asymmetrica*
1. Leaf blades stiffly coriaceous to cartilaginous, nitid at least above, the apices obtuse, broadly rounded or truncate, without round magenta glands abaxially.
  5. Leaf blades coriaceous, rarely thickly so, but the secondary veins prominent above and below; inflorescence erect, the rachis flattened; bracteoles numerous, small, similar to the sepals; flowers numerous.
    6. Petioles broadly marginate, 3–10 mm long; leaf blades obovate to very widely obovate, the bases cuneate, fully decurrent to petiole base; inflorescence rachis longitudinally ribbed, not alate; stigmas on persistent styles, ca. 1 mm long; fruit ovoid at first, then fusiform at maturity ..... 5. *C. melchiorii*
    6. Petioles canaliculate, 15–25(–28) mm long; leaf blades oblong, elliptic or rhombic, the bases obtuse, not decurrent on petiole; inflorescence rachis narrowly alate; stigmas sessile; fruit subglobose at first, then globose at maturity ..... 6. *C. cardonae*
  5. Leaf blades thickly coriaceous to cartilaginous, the secondary veins not easily discernible without magnification; inflorescence pendent, the rachis not flattened; bracteoles few, smaller than the sepals; flowers solitary or in a few-flowered, pyramidal compound cyme.
    7. Petioles broadly marginate; flowers solitary (–3) or in reduced, 6-flowered cymes; stigmas on persistent styles; fruits ovoid to subglobose, strongly ribbed.
      8. Petioles, 6–15 mm long; flowers terminal, solitary; petals obovate to orbicular; staminodes 8–9.
        9. Leaf blades 2.5–4.5 cm wide; bracteoles 3.5–4 mm long; sepal margins not scarious; petals 6; carpels 6–8 ..... 7. *C. hexacarpa*
        9. Leaf blades 5–7 cm wide; bracteoles 12–14 mm long; sepal margins scarious; petals 8; carpels 7–10 ..... 8. *C. radiata*

8. Petiole obsolete to 6 mm long; flowers in an axillary, branched, 3–6-flowered cyme; petals suborbicular; staminodes 4 ..... 9. *C. maguireana*
7. Petioles canaliculate; flowers in 6–18-flowered cymes; stigmas sessile to subsessile; fruits globose, smooth, without ribs.
10. Leaf blades obtuse to broadly rounded basally; peduncle 3–5 mm long; sepals 4–6, suborbicular; petals coriaceous; staminodes numerous; stigmas orbicular, sessile. .... 10. *C. opaca*
10. Leaf blades broadly acute to obtuse basally; peduncle 5–12 mm long; sepals 2, oblate; petals cartilaginous; staminodes 4; stigmas pentagonal, subsessile. .... 11. *C. guayanae*

1. ***Clusia duidae*** Gleason, Bull. Torrey Bot. Club 58:402. 1931. TYPE. VENEZUELA. AMAZONAS: Cerro Duida, slopes of ridge 25, 1,800–2,200 m, (fr), Tate 429 (HOLOTYPE: NY!; ISOTYPE: F!).

Shrub or small tree to 4 m tall; branchlets decussately short-alate, the wings 1–1.8 mm wide. Leaves petiolate; blades chartaceous to subcoriaceous, oblong or oblanceolate, 6–8 cm long, (1.4–)2.1–4 cm wide, apex acute, base abruptly acute, symmetric, dull above, pallid and bearing round, magenta glands below, midrib slightly prominent above, prominently raised below, secondary veins numerous, prominently raised above and below, united by a submarginal collecting vein, the margin flat, entire, glabrous; petioles obsolete. Inflorescence terminal, erect, pyramidally paniculate, 5–7(–8) cm long, 6–9 cm wide, the flowers cymose; peduncle 2.0–3.5 cm long; secondary bracts coriaceous, ovate, 2–5 mm long, apex acute, carinate; bracteoles 2, coriaceous, cordate, 2.4–2.6 mm long, 2.5–2.7 mm wide, apex acute to obtuse, base somewhat auriculate, carinate, the margin entire, opaque; not scarious; pedicels angulate, 6–12 mm long. Staminate flowers unknown. Pistillate flowers yellow; sepals 6, coriaceous, suborbicular, 4–6 mm long, 5.2–6 mm wide, apex broadly rounded, carinate, linear latex canals few, inconspicuous, the margin entire, hyaline, scarious; petals 5, coriaceous, acropetally smaller, obovate, the outer pair opposite, 4–4.5 mm long, 3–3.5 mm wide, apex broadly rounded, somewhat cucullate, linear latex canals few, inconspicuous, the margin entire, opaque, not scarious; staminodes 4, linear, 2.2–2.5 mm long, the filaments 1.2–1.5 mm long, 1.3 mm wide at base, the anthers linear, 1 mm long, apex muticous, base obtuse; pistil oblong, 3–3.5 mm long, 2–2.5 mm diam., carpels 4; styles angular, thick, ca. 3 mm long, stigmas orbicular, 1.6 mm long and wide. Fruit prismatic, 15–30 mm long, 6–8 mm wide, costate.

*Distribution.*—Endemic to the Guayana Crystalline Shield, Duida-Marahuaca Subprovince of Maguire (1979), at 1,225–2,200 m elevation.

*Ecology and conservation status.*—*Clusia duidae* occurs in mossy elfin forest formations, where it forms mats of interwoven stems. Label data indicate it is locally common, and the fact that its known range falls within national parks indicates that it is probably not threatened.

Representative specimens examined: **VENEZUELA**. Depto. Atabapo: slope of Cerro Marahuaca, upper Río Yameduaka, 03°38'N, 65°28'W, 1,225 m, 17–18 Feb 1985 (fr), *R. Liesner 17603* (BRIT, MO, VEN); Cerro Marahuaca, SE slopes, below Salto Los Monos on tributary of Río Iguapo, at headwaters, 03°35'N, 65°23'W, 1,500–1,600 m, 11 Mar 1985 (pist. fl, fr), *R. Liesner 18533* (MO, VEN), 20 Oct 1988 (fr), *R. Liesner 25135* (BRIT, MO, VEN); Cerro Marahuaca, SW-facing slopes, headwaters of Río Iguapo, S sector of the SE mountain, 03°36'00" N, 65°23'10" W, 1,560 m, 13–14 Oct 1983 (pist. fl, fr), *J. Steyermark 129648* (BRIT, MO, VEN); Cerro Huachamacari, Río Cunucunuma, vicinity of summit camp, 1,800 m (pist. fl), *B. Maguire et al. 30017* (F, NY, US, VEN).

*Clusia duidae* appears to be most closely related to *C. grammadenioides*, but is easily distinguished by its sessile leaves with abruptly acute leaf bases, entire sepals, and smaller inflorescence.

## 2. *Clusia grammadenioides* Pipoly, sp. nov. (Fig. 1)

Ob ramulorum internodiis quadrangulatosque alatos, folia sessilia atque canalis resiniferis permanifeste praeditis *C. duidae* valde affinis, sed ab ea ramulis later (non anguste) alatos, foliorum bases sensim largo decrescentes (nec abrupte acutes), petiolos late marginatos 5–10 mm longos (non obsoletos), sepalis secus marginem eroso-dentatis (nec integerrimis), promptem dignoscenda.

Hemiepiphyte, attaching to tree trunks by adventitious roots; branchlets tetragonal, broadly and decussately alate, 3–5 mm diam., the wings 2–8 mm wide, (therefore the stem appearing 8–13 cm diam.), the wings thinly cartilaginous, glabrous. Leaves petiolate; blades subcoriaceous, narrowly elliptic to obovate, (9.5–)14–19(–25) cm long, (2–)2.5–5(–6) cm wide, apically broadly to narrowly acute, basally long-attenuate, decurrent on the petiole, symmetric, bearing round magenta secretory glands below, without conspicuous latex canals, midrib raised above and below, secondary veins numerous, prominent above and below, united by a prominent submarginal collecting vein, glabrous, the margin revolute, thin, entire; petioles broadly marginate, 0.5–1 cm long, glabrous. Staminate inflorescence erect, terminal, tripinnately pyramidal paniculate, 8–9 cm long, 11–17 cm wide, the flowers cymose; peduncle obsolete to 3 mm long; bracteoles 2, coriaceous, oblate, 1.8–2 mm long, 2.3–2.5 mm wide, apex rounded to obtuse, margin scarious, the band to 0.3 mm, incised with 2–3 incisions, glabrous; pedicel tetragonal, 2.2 mm long, glabrous. Staminate flowers white, cymose; sepals 8, chartaceous, dimorphic, the outer whorl 2, opposite to the bracteoles, oblate, 2.5–2.6 mm long, 3–3.2 mm wide, apex rounded, somewhat cucullate, latex canals consipuous, linear, submarginal, the margin scarious and hyaline, variously incised-erose, appearing serrulate-dentate, the border of 0.5 mm wide, glabrous, the inner whorl 6, imbricate, chartaceous, suborbicular to oblate 3.8–4.2 mm long, 4–5.6 mm wide, apex obtuse, cucullate, the latex canals lineate, prominent, submarginal, the margin hyaline, erose-fimbriate; petals 5, contorted, coriaceous, acropetally smaller, oblong to widely ovate, 4.2–4.6 mm long, 2.4–3.4 mm

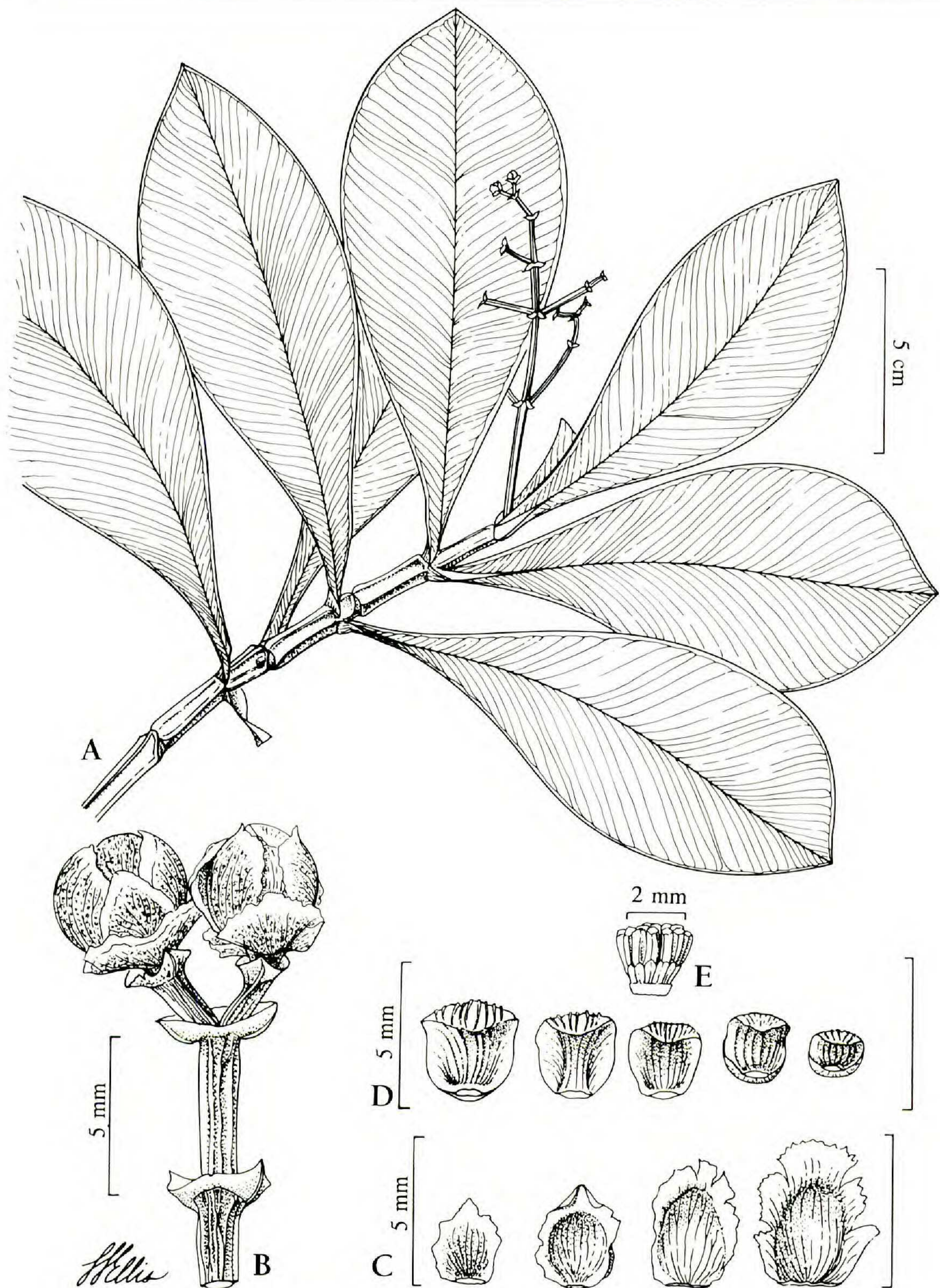


FIG. 1. *Clusia grammadenioides* Pipoly. A. Habit, showing the alate branchlets. B. 2-flowered cyme. C. Sepals, showing the scarios, hyaline, incised-erose margins. D. Petals, showing the linear latex canals, entire margins, and cucullate habit. E. Androphore, and adroecium. A-E, drawn from type.

wide, apex rounded, highly cucullate, not carinate, latex canals very prominent, marginal, the margin hyaline, ca. 0.3 mm broad, entire, glabrous; receptacle concave, without resin; androphore pentagonoid, 2 mm long, 1.5–1.7 mm tall, 1.3 mm wide; stamens 18, 1.7–1.8 mm long, the filaments flat, 0.3–0.4 mm long, the anthers muticous, 1.4–1.5 mm long, 0.5 mm wide, the apex emarginate, base cuneate, longitudinally dehiscent entire length; the connective medially darkened on both sides; pistillode absent. Pistillate flowers unknown. Fruit unknown.

TYPE. VENEZUELA. AMAZONAS: Huachica, 11 km NE of San Carlos de Río Negro, 1°58'N, 67°03'W, 120 m, 13 Nov 1977 (stam. fl), *R. Liesner & J. Hall 3447* (HOLOTYPE: VEN; ISOTYPES: MO, 2-shots).

PARATYPES: COLOMBIA. CAQUETÁ: Araracuara, 00°37'S, 72°24'W, 10 Dec 1991 (ster.), *J. Duivenvoorden et al. 2673* (BRIT, COAH, COL); Araracuara, Villa Azul, Río Caquetá, left bank, in front of Sumaeta Island, 00°34'S, 72°08'W, 200–300 m, 4 Nov 1989 (ster.), *C. Londoño et al. 1150* (BRIT, COAH, COL, JAUM, U). VENEZUELA. AMAZONAS: 0.5–3 km NE and E of San Carlos de Río Negro, N of airstrip, 01°51'N, 67°03'W, 120 m, 22 Jan 1980 (ster.), *R. Liesner 8576* (MO, NY, VEN).

*Distribution.*—Amazon Basin of Venezuela and Colombia, in lowland areas of the Guayana Crystalline Shield, at 120–300 m elevation.

*Ecology and conservation status.*—*Clusia grammadenioides* occurs along steambanks on terraces just above floodline at forest margins on deep white sands. Because these areas are in such close proximity to major, frequently travelled river systems, this species should be considered threatened.

*Etymology.*—The epithet “grammadenioides” refers to the resemblance of the leaves of this species to those of several species of *Cybianthus* subgenus *Grammadenia* (Myrsinaceae).

The decussate wings of the branchlets apices and chartaceous leaves indicate a close relationship with the parapatric *Clusia duidae*. However, the broadly marginate petioles, short or obsolete peduncle, and sepals with scarious, hyaline and incised-erose margins clearly distinguish *Clusia grammadenioides* from *C. duidae*.

### 3. *Clusia multilineata* Pipoly, sp. nov. (Fig. 2)

Propter folia tenuiter coriacea ad apicem necnon basem attenuata, subter glandulas punctatas puniceas induta atque lineas laticiferis atras praedita, non nunquam perianthii membra cucullata carinatasque ad *C. asymmetrica* Pipoly valde affinis sed ab ea foliis symmetricis necnon ellipticis (non asymmetricis necnon oblanceolatis), petiolis tenuis 1–1.5 (nec crassis 2–3.5) cm longis, denique cyma a eas ter (nec quater) ramificantibus facile cognoscitur.

Tree 3 m tall; branchlets subterete to weakly tetragonal, the corners rounded, not alate, 3–3.5 mm diam., subterete with age, glabrous. Leaves petiolate; blades chartaceous, elliptic, 8–13 cm long, (4.0–)5–5.5(–6.2) cm wide, apex and base acute, the base decurrent on the petiole, symmetric,

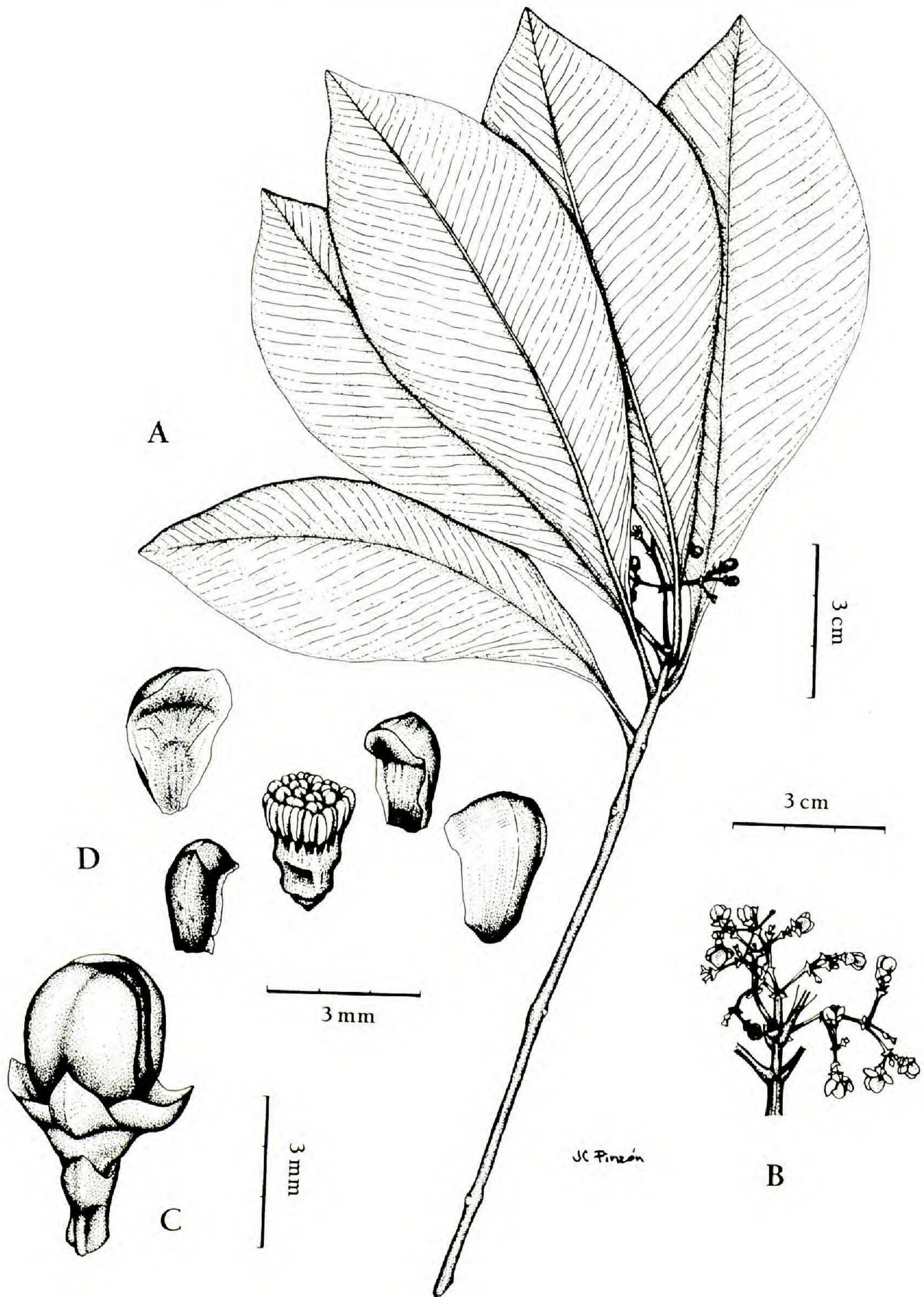


FIG. 2. *Clusia multilineata* Pipoly. A. Habit. B. Inflorescence. C. Staminate flower buds. D. Petals and androecium. A-E, drawn from type.



bearing round magenta secretory glands and numerous, conspicuous linear latex canals below, glabrous, midrib raised above and below, secondary veins numerous, prominent above and below, united by a submarginal collecting vein, the margin entire, revolute; petioles marginate, ligulate, thin, 1–1.5 cm long, glabrous. Staminate inflorescence terminal, erect, pyramidally paniculate, trichasial, 2.5–5 cm long, 3–7 cm wide, the flowers cymose; peduncle 0.5–1.0 cm long; bracteoles 2, opposite, cartilaginous, ovate, 1.5–1.6 mm long, 2–2.4 mm wide, apex acute to acuminate, carinate, w/o conspicuous latex canals, the margin scarious, entire, the border less than 0.1 mm wide, glabrous; pedicels 2–4 mm long, tetragonal. Staminate flowers greenish-white; sepals 7, the lower 4 decussate, the upper 3 contorted, chartaceous, suborbicular, more or less equal in size, 2.2–2.4 mm long, 2–2.2 mm wide, apex obtuse, rugose medially toward the apex, slightly carinate, the margin scarious, entire, the border to 0.2 mm wide; petals 4, decussate, thickly carnose, without conspicuous latex canals, suborbicular, slightly carinate, the outer pair 4.0–4.2 mm long, 3.2–3.4 mm wide, apex rounded, cucullate, the margin entire, revolute, the inner pair 2.9–3.1 mm long, 2.0–2.2 mm wide, apex rounded, strongly cucullate, the margin entire, strongly revolute; receptacle concave, without resin; androphore rectanguloid, 0.8–1.1 mm high, 1.4–1.5 mm long, 1.1–1.2 mm wide; stamens 22–24, 1.1–1.3 mm long, the filaments free, clavate, 0.3–0.4 mm long, broadly conic at base, the anthers muticous, obovoid, 0.8–0.9 mm long, 0.4–0.5 mm wide, apex emarginate, base obtuse, dehiscent by longitudinal slits for entire length; pistillode absent. Pistillate flowers unknown. Fruit unknown.

TYPE: VENEZUELA. AMAZONAS. Depto. Río Negro: Cerro de la Neblina, Camp IV, 15 km NNE of Pico Phelps; 0°51'N, 65°57'W, 780 m; 15–18 Mar 1984 (stam. fl), *R. Liesner* 16649 (HOLOTYPE: VEN; ISOTYPES: BRIT, MO, US).

*Distribution.*—Presumably endemic to Cerro de la Neblina, Amazonas, Venezuela, 780 m, known only from the type.

*Ecology and conservation status.*—*C. multilineata* is restricted to river canyons of Cerro de la Neblina. Cerro de la Neblina is very remote and lies within a national park and thus, is protected.

*Etymology.*—The specific epithet refers to the numerous, conspicuous linear latex canals of the leaf blades, which appear translucent upon drying.

*Clusia multilineata* is closely related to *C. asymmetrica* Pipoly of Cerros Marahuaca and Aracamuni, but can immediately be recognized by its elliptic and symmetric leaves, thin petioles, and 3-branched inflorescences.

#### 4. *Clusia asymmetrica* Pipoly, sp. nov. (Fig. 3)

Species notabilis haec en *C. multilineata* diagnosem antequam referantur ad illa foliis asymmetricis necnon oblanceolatis (non symmetricis necnon ellipticis), petiolis crassis

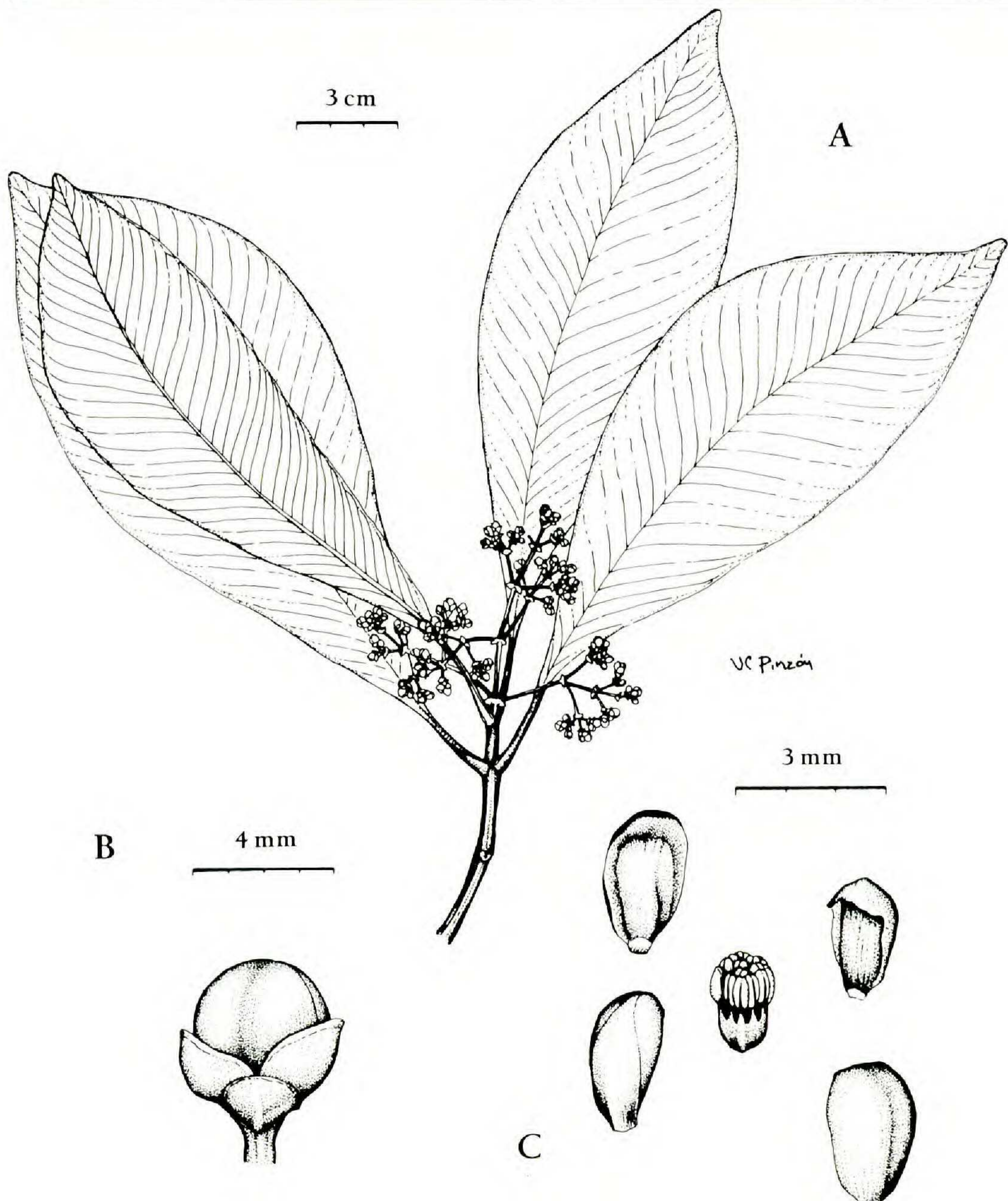


FIG. 3. *Clusia asymmetrica* Pipoly. A. Habit. B. Staminate flower bud. C. Petals and androecium. A-E, drawn from type.

2.0–3.5 (nec tenuis 1.0–1.5) mm longis, denique cyma a eas quater (non ter) ramificantibus statim separabilis.

Tree 6 m tall; branchlets tetragonal, the corners not alate, 4–6 mm diam., remaining angular with age, glabrous. Leaves petiolate; blades thinly coriaceous, oblanceolate, (12–)15–20(–22) cm long, (4.8–)5–8(–9) cm wide, apex and base acute, the base decurrent on the petiole, asymmetric, bearing round magenta secretory glands and conspicuous linear latex canals below, glabrous, the margin entire; petioles trigonal, ligulate, thick, 2.0–3.5 cm

long, glabrous. Staminate inflorescence terminal, pendent, pyramidally paniculate, 4-branched, 3–7 cm long, 7–10 cm wide, the flowers cymose; peduncle 0.3–1 cm long; bracteoles 2, opposite, thickly cartilaginous, very broadly ovate, 3.6–3.8 mm long, 5–5.2 cm wide, apex rounded, medially rugose and prominently carinate, w/o conspicuous latex canals, the margin scarious, irregularly incised, the border ca. 0.4 mm wide, glabrous; pedicels 1 mm long, tetragonal. Staminate flowers white; sepals 4, chartaceous, orbicular, more or less equal in size, 4.0–4.2 mm long and wide, apex rounded, carinate and cucullate, rugose medially toward the base, the margin scarious, irregularly incised, the border to 0.4 mm wide, glabrous; petals 4, imbricate, coriaceous, obovate, 4.8–5 mm long, 3–3.2 mm wide, apex rounded, latex canals numerous, conspicuous, the margin entire, flat; receptacle concave, without resin; androphore rectanguloid, 1.4–1.6 mm high, 3.8–4.1 mm long, 1.8–2 mm wide; stamens 18, 3.2–3.3 mm long, the filaments basally connate forming a non-resinous mass of tissue 1.8–2.1 mm tall, apically free 1.4–1.6 mm, subclavate, 0.4–0.5 mm long, terete at base, the anthers muticous, ovoid, 0.8–1 mm long, 0.5–0.6 mm wide, apex rounded to subemarginate, base acute, dehiscent by longitudinal slits for entire length, the connective not darkened; pistillode highly reduced, sparingly resiniferous, with hollow ovary and 5 styles and reduced stigmatic areas. Pistillate flowers and fruit unknown.

TYPE: VENEZUELA. AMAZONAS. Depto. Atabapo: Cerro Marahuaca, "Sima" area, 03°43'N, 65°30'W, 1200 m, 16 Oct 1988 (stam. fl), *R. Liesner* 24972 (HOLOTYPE: VEN; ISOTYPES: BRIT, MO).

PARATYPES: VENEZUELA. AMAZONAS. Depto. Río Negro: Cerro Aracamuni, 01°39'N, 65°40'W, 250 m, 4 Nov 1987 (stam. fl bud), *R. Liesner & G. Carnevali* 22797 (MO, VEN). Depto. Atabapo: affluent of Caño Negro at junction with Río Cunucunuma, water source from Cerro Marahuaca, 1,000–1,200 m, 19 Oct 1988 (stam. fl), *H. Rodríguez* 2875 (MY, NY).

*Distribution.*—Endemic to southern Amazonas of Venezuela, on Cerro Marahuaca and Cerro Aracamuni, at 250–1,200 m elevation.

*Ecology and conservation status.*—*Clusia asymmetrica* occurs in the "sima" areas (sinkholes) of the upper plateaus of Cerro Marahuaca and the open "lajas" of Cerro Aracamuni. "Simas" have low-level light regimes, high level moisture, but are shielded from the strong winds of the open areas on the tepui summits. The "laja" formations described on the label of *Liesner & Carnevali* 22797 are protected from winds by tall forests which surround them. While the environment on the tepuis is a fragile one, the southern tepuis are within national parks and therefore, are protected. Despite the fact that this species is known from two very different elevational ranges, it is possible that exposure to wind, alternating periods of high humidity and aridity, concomitant with nutrient poverty are critical factors in determining the species' success.

*Etymology*.—The specific epithet refers to the asymmetric leaves, unique within the genus *Clusia*.

Within *Clusia* section *Criuva* (*sensu stricto*), *C. asymmetrica* is easily distinguished by its long, trigonal petioles and asymmetric leaves. The 4-branched cymes wider than tall are also distinctive.

5. *Clusia melchiorii* Gleason, Bull. Torrey Bot. Club. 58:403. 1931. TYPE. VENEZUELA. AMAZONAS: Cerro Duida, Desfiladero, 1,850 m, G. Tate 705 (HOLOTYPE: NY!; ISOTYPE: US!).

*Clusia melchiori* Gleason, orth. var., *ibid.*

Terrestrial, free-standing shrub or small tree to 4 m tall; branchlets subterete, angulate, (3–)7–12 mm diam., not alate, glabrous. Leaves petiolate; blades coriaceous or rarely thickly coriaceous, obovate to widely obovate, rarely oblong, (6.5–)8–10(–17) cm long, (2.8–)5.5–8(–11) cm wide, apex broadly rounded to truncate, base cuneate, fully decurrent to petiole base, symmetric, without round magenta glands, linear latex canals inconspicuous, nitid above, pallid below, midrib prominently raised above and below, secondary veins numerous, united by a submarginal collecting vein, the margin revolute, entire, glabrous; petiole broadly marginate, 3–10 mm long, glabrous. Inflorescence terminal, erect, pyramidally paniculate, (4.5–)8–11(–19) cm long, (4.2–)6–11 cm wide, the flowers cymose, in 7–9's; peduncle flattened, (2–)3.5–4.5 cm long, longitudinally ribbed, not alate, subtended by 2 reduced leaves similar to vegetative leaves but 6–8 cm long, 2–3.5 cm wide; secondary inflorescence bracts cartilaginous, oblate, 2–5 mm long, 6–8 mm wide, apex broadly rounded, strongly carinate, the margin opaque, scarious, entire, glabrous; secondary peduncles similar to basal one, 5–10 mm long; bracteoles (4–)6–12(–14), decussate, coriaceous, oblate, 2.5–3.5 mm long, 3.5–4.5 mm wide, apex obtuse, the margin entire, hyaline, scarious, glabrous; pedicels tetragonal, 1–3 mm long. Staminate flowers yellowish-white; sepals 4, decussate, the outer coriaceous, oblate, 3.5–4 mm long, 4–4.5 mm wide, apex obtuse, carinate, the margin hyaline, scarious; petals 4–6, carnose, obovate, 3–3.5 mm long, 2.5–3 mm wide, apex broadly rounded, linear latex canals inconspicuous, the margin entire, opaque, not scarious, glabrous; androphore rectanguloid; stamens numerous, ca. 3–3.5 mm long, the filaments flat, 2.8–3 mm long, the anthers muticous, oblong, ca. 0.5 mm long, 0.2 mm wide, apex rounded, base fused to filament, the connective not darkened. Pistillate flowers (bud) as in staminate, sepals identical; petals unknown; staminodes 4, linear, 1–1.5 mm long, the filaments 1–1.3 mm long, the anthers muticous, oblong, 0.2–0.5 mm long, 0.1–0.2 mm wide, apex rounded, base fused to filament; pistil oblong to obovoid, 1.5–3 mm long, 2–4 mm wide; carpels 4; styles 4, erect, connivent, 2–2.4 mm long; stigmas cuneiform, subpeltate, 0.6–

0.8 mm long and wide; ovules 4 per locule. Fruit ovoid, then fusiform at maturity, 10–13 mm long, 3–8 mm wide.

*Distribution*.—Amazonian Colombia and Brazil, eastward to Surinam on sandstone mountains of the Guayana Crystalline Shield and its satellites, 1,200–3,000 m.

*Ecology and conservation status*.—*Clusia melchiorii* occurs in elfin forests, often dominated by *Bonnetia* species, where it is a conspicuous element of the vegetation along margins of the forest on rocky slopes. It is a common species throughout its range and is not threatened at this time.

Specimens examined. VENEZUELA. Amazonas: Caño Verada, Campo M. Pérez to Camp Verada, 900–1,100 m, 30 Jan 1951 (fr), *B. Maguire et al.* 31665 (NY, US, VEN); Cerro Duida, Cerro Culebra, 1,500 m, 22–24 Apr 1949 (fr), *B. Maguire & B. Maguire, Jr.* 29124 (NY, VEN), Culebra Valley, Río Cunucunuma, 1,500 m, 19 Nov 1950 (fr), *B. Maguire et al.* 29535 (NY, US, VEN); Cerro Guanay, ridge and savanna, W camp, 1,800 m, 4 Feb 1951 (fr), *B. Maguire et al.* 31746 (NY, VEN); Cerro Moriche, Río Ventuari, Amazonas, 1,500 m, 15 Jan 1951 (fr), *B. Maguire et al.* 30927 (NY, VEN), Cerro de la Neblina, Río Yatua, 2–8 km S of Camp 3, 1,000 m, 24 Dec 1953 (fr), *B. Maguire et al.* 36905 (NY, US, VEN), cumbre between Cumbre Camp and N escarpment, 1,700–1750 m, 13 Jan 1954 (pist. fl), *B. Maguire et al.* 37248 (NY, US, VEN), trail from camp to N escarpment, 1,800–1,900 m, 17 Nov 1957, (fr), *B. Maguire et al.* 42124 (NY, US, VEN), upper basin of Cañon Grande, above Salto Grande, 1,900–2,000 m, 13 Dec 1957 (fr), *B. Maguire et al.* 42731 (NY, US, VEN), E escarpment of Upper Caño Grande Basin, 2,000 m, 13 Dec 1957 (fr), *B. Maguire et al.* 42377 (NY, US, VEN), talus forest between Camps 3 and 4, 700–1,300 m, 1 Jan 1958 (fr), *B. Maguire et al.* 42758 (NY, US, VEN), headwaters of Caño Grande, SW portion, 1,900 m, 16–17 Oct 1970 (stam. fl), *J. Steyermark* 103992 (NY, VEN); Planicie de Zuluoaga, Río Titirico, 2,300 m, 10–15 Oct 1970 (stam. fl), *J. Steyermark* 103847 (NY, VEN); Neblina Massif, Camp 2, 2.8 km NE of Pico Phelps, 00°49'N, 65°59'W, 15 Apr 1984 (fr), *B. Stein & A. Gentry* 1535 (BRIT, MO, NY, US, VEN); Sierra Parima, 02°27'24" N, 63°56'W, along Venezuelan-Brazilian border, 45 km NW of headwaters of Río Orinoco, 1,300 m, 18–23 May 1972 (stam. fl), *J. Steyermark* 105958 (NY, VEN); Serranía Parú, Río Parú, Caño Asísa, Río Ventuari, 6 km along W rim, 2,000 m, 4 Feb 1951 (stam. fl), *R. Cowan & J. Wurdack* 31224 (NY, US, VEN), (stam. fl), *R. Cowan & J. Wurdack* 31257A (NY, US, VEN), (fr), *R. Cowan & J. Wurdack* 31258 (NY, US, VEN); Cerro Sipapo (Paráque), SE peak, W Mountain, 2,000 m, 20 Dec 1948 (stam. fl), *B. Maguire & L. Politi* 27781 (NY, US, VEN), N escarpment, 1,400 m, 23 Dec 1948 (stam. fl), *B. Maguire & L. Politi* 27894 (NY, US, VEN), Caño Grande, 1 km NW of Campo Grande, 1,400 m, 28 Dec 1948 (fr), *B. Maguire & L. Politi* 28014 (NY, US, VEN); Caño Profundo, 1,400 m, 12 Jan 1949 (stam. fl), *B. Maguire & L. Politi* 28302 (NY, US, VEN), 1 km above Intermediate Camp, 600 m, 6 Feb 1949 (fr), *B. Maguire & L. Politi* 28797 (NY, US, VEN); Cerro Yapacana, Río Orinoco, summit, 1,200 m, 2 Jan 1951 (fr), *B. Maguire et al.* 30642 (NY, US, VEN), broken cumbre at 1,200 m, 5 Jan 1951 (fr), *B. Maguire et al.* 30740 (NY, US, VEN), summit, 03°45'N, 66°45'W, 1,000–1,200 m, 5–7 May 1970 (fr), *J. Steyermark* 103159 (NY, VEN); Sierra Maigualida, NW sector, small valley along an upper tributary of Caño Iguana, 05°30'N, 65°15'W, 2,000 m, 28 Feb–3 Mar 1991 (fr), *P. Berry et al.* 4886 (BRIT, MO, VEN); *P. Berry et al.* 4926 (MO, VEN); Serranía de Tapirapeco, Campo Tamacuari, stream trail from camp, 01°14'N, 64°40'W, 1,300 m, 10 Feb 1989 (fr), *H. Beck et al.* 938 (BRIT, NY, VEN); Cerro Yaví, 2,000–2,300 m, 1–3 Mar 1947 (stam. fl), *K. Phelps & C. B. Hitchcock* 78 (NY, VEN), Valley of Río Coro-

Coro, W of Serranía de Yutajé, plateau W of river, 5°42'N, 66°10'W, 1,300 m, 7 Mar 1987 (fr), *B. Holst & R. Liesner* 3387 (MO, VEN); Serranía Yutajé, Río Manipiare, NW ridge, 1,400 m, 11 Feb 1953 (fr), *B. Maguire & C. Maguire* 35174 (NY, VEN). **Bolívar:** Distrito Piar, Auyán-tepuí, N portion of S section, W division of mountain, along Río Churún, between N and S camp at foot of "second wall", 1,600 m, 14 May 1964 (fr), *J. Steyermark* 93881 (NY, VEN), S-central region, headwaters of Río Churún, 05°51'N, 62°32'W, 200 m, 30 Mar 1987 (stam. fl bud), *B. Holst* 3784 (MO, VEN), summit of central part of NW arm, W division of mountain, along small creek S of the Jimmy Angel airplane, 1,800 m, 7 May 1964 (fr), *J. Steyermark* 93538 (NY, VEN); Chimantá Massif, Central Section, NNW of Summit Camp, 1,970 m, 19 Feb 1955 (fr), *J. Steyermark & J. Wurdack* 942 (NY, VEN), Toronó-tepuí, N-facing slopes on summit above valley of Caño Mojado, 2,030–2,150 m, 21 Feb 1955 (stam. fl), *J. Steyermark & J. Wurdack* 1017 (NY, VEN), Vicinity of Bluff Camp, at base of W-facing bluffs of Toronó-tepuí, 1,700 m, 2–4 Jun 1953 (fr), *J. Steyermark* 75625 (NY, VEN); Abacapá-tepuí, NW part of summit, 2,000–2,125 m, 14 Apr 1953 (fr), *J. Steyermark* 75005 (NY, VEN), Sarvén-tepuí, between Camp 4 & 5, 1,500–1,750 m, 8 Jan 1953 (stam. fl), *J. Wurdack* 34092 (NY, VEN), Cerro Guaiquinima, Río Paragua, slopes below W escarpment, 1,600 m, 31 Dec 1951 (fr), *B. Maguire* 32891 (NY, VEN), summit, NE section, near cliffs, near headwaters of Río Carapo, 05°59'N, 63°25'W, 1,490–1,500 m, 25 May 1978 (fr), *J. Steyermark et al.* 117320 (NY, VEN); Meseta de Guaiquinima, S section, along Río Carapo, 8 km N of Salto Carapo, 05°51'N, 63°33'W, 900 m, 6 Dec 1987 (fr), *O. Huber* 12437 (MYE, NY, VEN); Alto Río Paragua, Río Guaña (Merevarí), near Brazilian frontier, 20 Oct 1943 (pist. fl, fr), *F. Cardona* 1036 (US, VEN); Meseta de Jaua, Cerro Jaua, summit of CW portion, 04°45' N, 64°26'W, 60 km NW of the Sanitary camp of the mission of Río Kanarakuni, 1,922–2,100 m, 22–27 Mar 1967 (stam. fl), *J. Steyermark* 98144 (NY, VEN), summit, 04°48'50" N, 64°34'10" W, SW part, along tributary of Río Marajano, 1,750–1,800 m, 22–28 Feb 1974 (stam. fl), *J. Steyermark et al.* 109363 (NY, VEN), E of camp, E of Río Marajano, 1,810–1,880 m, 28 Feb -5 Mar 1974 (stam. fl), *J. Steyermark et al.* 109654 (NY, VEN); Summit of SE-facing escarpment, E of Cerro El Picacho, N of Las Nievers and Las Chicharras, 45 km N of Tumeremo, vicinity of Deborah, Altiplanicie de Nuria, 600–650 m, 5–8 Feb 1961 (fr), *J. Steyermark* 89049 (NY, VEN), NW slopes of Ptari-tepuí, 1,600–2,000 m, 17 Dec 1952 (fr), *B. Maguire & J. Wurdack* 33905 (NY, VEN), "moss forest" cumbre, N valley, 1,700 m, 4 Jan 1952 (fr), *B. Maguire* 32990 (NY, VEN), along base of S-facing bluffs, 2,410 m, 6 Nov 1944 (pist. fl), *J. Steyermark* 59903 (F, NY, US, VEN); Ilu-tepuí, vicinity Camp No. 1, 1,500 m, 13 Mar 1952 (fr), *B. Maguire* 33391 (NY, VEN); Uaipan-tepuí, W peak, 1,930 m, 4 Mar 1967 (stam. fl), *T. Koyama & G. Agostini* 7482 (NY, VEN); Sierra Pakaraima, headwaters of Río Paragua, along Venezuelan-Brazilian border, No. 15, 03°40'N, 63°00'W, 1,400 m, 4–5 May 1973 (stam. fl), *J. Steyermark* 107282 (NY, VEN); Cerro Roraima, SW-facing slopes between Rondón Camp and base of bluffs, 2,040–2,225 m, 30 Sep 1944 (stam. fl), *J. Steyermark* 58945 (F, NY, US, VEN), SW-facing slopes, Jan 1939 (fr), *A. Pinkus* 161 (NY, VEN). **GUYANA. Mazaruni-Potaro Region:** Upper Mazaruni River Basin, Pakaraima Mts., along Karowrieng River, unnamed peak NW of Maipuri Falls, 05°43'N, 60°08'W, 1,385 m, 13 Jun 1986 (fr), *J. Pipoly & K. Alfred* 7711 (BRG, NY, US), Headwaters of Karowrieng River, 06°12'N, 60°07'W, 712 m, 15 Jun 1986 (bud), *J. Pipoly & K. Alfred* 7789 (BRG, NY, US); N of Imbaimadai airstrip, 05°43'N, 60°18'W, 511 m, 15 Jun 1986 (fr), *J. Pipoly & K. Alfred* 7821 (BRG, NY, US). **Cuyuni-Mazaruni Region:** Chi-Chi Mts., 4 km W of Chi-Chi Falls, on tributary leading N from Mazaruni River, 05°34'N, 60°15'W, 450 m, 18 Feb 1987 (fr), *J. Pipoly et al.* 10293, 10330 (FDG, NY, US). **Upper Potaro-Siparuni Region:** summit of Mt. Wokomung, 05°05'N, 59°50'W, 1,650 m, 7 Jul 1989, (pist. fl bud), *B. Boom & G. Samuels* 9120 (BRG, BRIT, NY); 1,530

m, 13 Jul 1989 (stam. fl bud), *B. Boom & G. Samuels* 9201 (BRG, BRIT, NY); Mt. Wokumung, central summit plateau, 0.5–1 km S, 1–2 km E along creek area and ridge, 05°04'N, 59°52'W, 1,500–1,530 m, 22 Feb 1993 (fr), *T. Henkel et al.* 1535 (BRG, US). **Upper Takatu-Upper Essequibo Region:** S. Pakaraima Mts., 5 km E of Tipuru Village, Ureisha Mt summit, 04°11'N, 59°31'W, 994 m, 4 Mar 1992 (fr), *B. Hoffman et al.* 1184 (BRIT, BRG, US); NW Kanuku Mts., summit of Nappi Mt., 12 km S of Nappi Village, 03°18'N, 59°33'W, 750–950 m, 8 Feb 1993 (fr), *B. Hoffman & R. Foster* 3567 (BRG, US); S Pakaraima Mts, Kopinang Falls and Savanna, 900 m, 29 Aug 1961 (stam. fl), *B. Maguire et al.* 45986A (FDG, K, NY, US), 31 Aug 1961 (stam. fl), *B. Maguire et al.* 46038a (FDG, K, NY, US), 3 Sep 1961 (stam. fl), *B. Maguire et al.* 46081A (FDG, K, NY, US); Kanuku Mts., Nappi Mt. 03°19'N, 59°34'W, 960 m, 11 Nov 1987 (fr), *M. Jansen-Jacobs et al.* 875 (NY, U, US). **SURINAM.** Wilhelmina Gebergte, Juliantops, 1,200 m, 3 Aug 1963 (stam. fl), *J. Schulz* 10303 (BBS, NY, US), 3 Aug 1963 (pist. fl), *J. Schulz* 10296 (BBS, NY, US); Juliana Top, 15 km N of Lucie River, 03°36'–03°41'N, 56°30'–56°34'W, 1,000–1,230 m, 18 Aug 1963 (stam. fl), *H. Irwin et al.* 54864 (BBS, NY, U, US); Tafelberg, escarpment 2 km S of East Ridge, 1 Sep 1944 (stam. fl), *B. Maguire* 24585a (BBS, NY, US), 1 Sep 1944 (pist. fl), *B. Maguire* 24585 (BBS, NY, US), between Savanna VIII and SW escarpment, 5 Sep 1944 (fr), *B. Maguire* 24641 (BBS, NY, U, US); Bakhuis Mts, along Kabalebo and Coppename Rivers, 800 m, 25 Feb 1965 (fr), *P. Florschütz & P. Maas* 3040 (NY, U). **FRENCH GUIANA.** Saül, S of Mt. Galbao, 13 Dec 1976 (fr), *J.J. de Granville* 5401 (CAY, NY, P); Mont Galbao, 14 Dec 1976 (fr), *S. Mori et al.* 8770 (CAY, NY, P); Mont Galbao, SE peak, 03°35'N, 53°16'W, 700 m, 13 Sep 1994 (stam. fl bud), *B. Boom* 10863 (CAY, NY); Mont Galbao, E sector, 03°36'N, 53°17'W, 650 m, 15 Jan 1986 (fr), *J. J. De Granville* 8761, 8762 (CAY, NY, P). **BRAZIL.** Amazonas: Platô da Serra Aracá, SE portion of Serra Norte, 00°51'N, 63°22'W, 1,150–1,250 m, 15 Feb 1984 (fr), *I. do Amaral, J. Pipoly et al.* 1593 (BRIT, INPA, MG, NY), 24 Feb 1984 (fr), *A. S. Tavares et al.* 139 (INPA, MG, NY), Plateau of northern massif of Serra Aracá, 01°51'–57'N, 63°21'–22'W, N part of N slope, 1,400 m, 21 Feb 1984 (fr), *G. Prance, J. Pipoly et al.* 29209 (INPA, MG, NY), W slope of southern massif, 00°40'N, 63°18'W, 1,000 m, 21 Mar 1984 (stam. fl), *J. Pipoly & G. Samuels* 6864 (INPA, MG, NY, US); 0–3 km N of km 211 of Perimetral Norte Hwy, Pico Rondon, ca. 01°32'N, 62°48'W, 3 Feb 1984 (fr), *J. Pipoly et al.* 6614 (INPA, MG, NY). **Terr. Roraima:** Serra Sebang, Vista General, 1,525 m, 16–18 Dec 1954 (fr), *B. Maguire* 40308 (NY).

Because of the unique flattened inflorescence rachis and peduncle, numerous flowers and numerous bracteoles similar to the sepals, *C. melchiorii* is most closely related to *C. cardonae*, but readily separated from it by the broadly marginate petioles, obovate to very widely obovate leaf blades with cuneate bases fully decurrent to the petiole base, and fruit ovoid at first, then fusiform at maturity.

## 6. *Clusia cardonae* Maguire, Mem. New York Bot. Gard. 9:483. 1957.

TYPE. VENEZUELA. BOLÍVAR: Uaipán-tepuí, Río Caroní, 1,700 m, 1–15 Feb 1948 (stam. fl), *K. Phelps & C.B. Hitchcock* 412 (HOLOTYPE: NY!; ISOTYPE: VEN).

Trees to 4 m tall; latex yellow, copious; branchlets 5–8 mm diam., acutely tetragonal, the corners sharp, upon drying appearing narrowly alate, the wings less than 0.5 mm wide. Leaves petiolate; blades stiffly coriaceous, oblong, elliptic, or rhombic, (5.5–)7–9(–11) cm long, (4–)6–8(–9.5) cm

wide, apex obtuse to broadly rounded, base obtuse, not decurrent on the petiole, symmetric, nitid above, pallid or rarely nitid below, without magenta glands, midrib elevated above and below, the secondary veins numerous, conspicuous above and below, united by a submarginal connecting vein, linear latex canals inconspicuous, numerous, the margin revolute, entire, glabrous; petioles canaliculate 15–25(–28) mm long, glabrous. Staminate inflorescence terminal, erect, pyramidally paniculate, 7–9(–11) cm long, (5–)6–8 cm wide, the flowers cymose; peduncle obsolete; subtended by two reduced leaves similar to vegetative leaves but obovate spatulate, 2.5–2.8 mm long, 1.2–2 mm wide; secondary inflorescence bracts carnose, widely ovate, 2–2.5 mm long, 2.3–2.5 mm wide, apex obtuse, medially carinate, the margin entire, opaque, not scarious, glabrous; bracteoles 4–8, decussate, coriaceous, ovate, similar in size and shape to the bracts; pedicels tetragonal, 2–3.5 mm long, glabrous. Staminate flowers yellow; sepals 4, decussate, carnose, oblate to suborbicular, 2–2.3 mm long, 2.2–2.4 mm wide, apex broadly rounded, subcucullate, the margin entire, opaque, not scarious, glabrous; petals 4–5, the outer pair opposite, the inner decussate or imbricate, coriaceous, suborbicular, 5–6 mm long and wide, apex broadly rounded, cucullate, linear latex canals inconspicuous, the margin entire, opaque, not scarious, glabrous; androphore pentagonoid; stamens numerous, 2–3.5 mm long, the filaments flat, 1–2 mm long, the anthers ovate, 0.8–1 mm long, apex rounded, the connective slightly exceeding the thecae, base cordate, the connective medially darkened; pistillode absent. Pistillate inflorescence as in staminate but pedicels 2–3 mm long; sepals 2–2.5 mm long, 2.4–2.7 mm wide; staminodes numerous, 1–1.5 mm long, the filaments 0.9–1.2 mm long, broadly triangular at base, connivent, the anthers ovoid to oblong, ca. 0.3–0.6 mm long, apex broadly rounded, base obtuse, fused to filament apex; pistil subglobose, 2.5–3 mm long and in diam.; styles obsolete; stigmas narrowly cuneiform, 1–1.5(–2) mm long, 0.5–0.8 mm wide, subpeltate, convex. Fruit subglobose, at first, then globose, yellowish-green, 5–9 mm long and in diam.

*Distribution.*—Endemic to the Guayana Crystalline Shield, *Clusia cardonae* is known from the state of Bolívar, Venezuela and nearby Guyana, at 920–1,825 m elevation.

*Ecology and conservation status.*—*Clusia cardonae* is a rare species, occurring on summits of tepuis which experience very little disturbance. It is locally common, and therefore is not likely to be threatened.

Representative specimens examined: VENEZUELA. Bolívar: Dtto. Piar: Chimantá-Massif, Aprada-tepuí, 1,400–1,500 m, Aug 1950 (stam. fl), *L. Bernardi* 931 (MER, NY, VEN); savanna at foot of Aprada-tepuí, 05°23'N, 62°27'W, 1,200 m, 5 May 1987 (stam. fl), *O. Huber* 12098 (MYE, NY, VEN); Camarcaibarai-tepuí, SW-facing shoulder, 05°52'N,



62°01'W, 1,800–1,825 m 22–24 May 1986 (fr), *J. Steyermark et al.* 131998 (MO, VEN); Cerro Amuray-tepuí, W division of Los Hermanos range, summit, 05°55'N, 62°15'W, 1,030 m, 27 May 1986 (fr), *J. Steyermark* 132175 (MO, VEN); Ilú-tepuí, ridge E of Mesa Grande, 1,650 m, 9 Mar 1952 (pist. fl), *B. Maguire* 33318, (stam. fl), *B. Maguire* 33319 (NY, VEN); mesa S of Terekeyuren-tepuí, 40 km NE of the Kamarata Mission, 05°51'N, 62°03'W, 1,780 m, 15 Jan 1986 (fr), *O. Huber & S. Gorzula* 11135 (MYF, NY, VEN); 25 km N of Luepa, along El Dorado-Luepa road, 05°55'N, 61°25'W, 1,350 m, 2 Sep 1986 (stam. fl), *O. Huber & L. Hernández* 11721 (MYF, VEN); Uaipán-tepuí, Río Caroní, 2,700 m, 26 Nov 1946 (stam. fl), *F. Cardona* 2064 (NY, VEN), summit of W peak, 1,980 m, 4 Mar 1967 (stam. fl), *G. Agostini & T. Koyama* 7458 (NY, VEN), between the W and E peaks of Uaipán, 1,500 m, 4 Mar 1967 (stam. fl), *T. Koyama & G. Agostini* 7473 (NY, VEN); Uei-tepuí, between SE slope and summit, between Luepa and Cerro Venamo, vicinity of km 125, S of El Dorado, 1,100–1,300 m, 7 Mar 1962 (stam. fl), *J. Steyermark & L. Aristeguieta* 22 (NY, VEN); vicinity of km 129–130, S of El Dorado, NE of Luepa, 800–1,200 m, 6–11 Mar 1962 (fr), *J. Steyermark & L. Aristeguieta* 90 (NY, VEN); Cerro Venamo, along Guyana border, 1,400–1,500 m, 1 Jan 1964 (fr), *J. Steyermark et al.* 92502 (NY, VEN), NW slopes, between road to campamento 125 and forest above waterfall, 1,100–1,300 m, 14 Apr 1960 (fr), *J. Steyermark & S. Nilsson* 112 (NY, VEN); ridge of Fila de La Danta, between campamento 125 and km 127, between Luepa and Cerro Venamo, 1,200 m, 15–17 Apr 1960 (fr), *J. Steyermark & S. Nilsson* 204 (NY, VEN). **GUYANA. Upper Mazaruni River Region:** Karowtipu Mountain, between camp and peak on W side of mountain, 05°45'N, 60°35'W, 920–1,180 m, 24 Apr 1987, *B. Boom & D. Gopaul* 7705 (BRIT, BRG, NY). **Cuyuni-Mazaruni Region:** Pakaraima Mountains, Kurupung River, top of Kamarau Falls, 06°06'N, 60°21'W, 350 m, 19 Jul 1992 (pist. fl, fr), *B. Hoffman* 2086 (BRG, BRIT, NY, US); Pakaraima Mountains, NE plateau of Mt. Ayanganna, 05°23'N, 59°58'W, 1,500 m, 30 Oct 1992 (pist. fl), *B. Hoffman* 3104 (BRG, BRIT, US); Mt. Ayanganna, easternmost peak, 05°25'N, 59°57'W, 1,350–1,380 m, 11 Mar 1987 (fr), *J. Pipoly et al.* 11102 (FDG, NY, US).

The coriaceous leaf blades with prominent secondary veins, erect, pyramidally paniculate inflorescence, flattened inflorescence rachis, and numerous, small bracteoles similar to the sepals serve to indicate that *Clusia cardonae* is most closely related to *C. melchiorii*. However, *C. cardonae* is readily separated by its canaliculate petioles, oblong, elliptic or rhombic leaves not decurrent on the petiole, sessile stigmas and globose fruits.

**7. *Clusia hexacarpa* Gleason, Bull. Torrey Bot. Club 58:403. 1931. TYPE:** VENEZUELA. Amazonas: Cerro Duida, streamside at Central Camp, 1,800 m (pist. fl), *G. Tate* 565 (HOLOTYPE: NY!).

*Clusia hexacarpa* var. *ptaritepuiana* Steyer., Fieldiana, Bot. 28:387. 1952. syn. nov. TYPE. VENEZUELA. Bolívar: Ptari-tepuí, S-facing slopes, vicinity of "Cave Rock," 1,800 m, 4 Nov 1944 (pist. fl), *J. Steyermark* 59866 (HOLOTYPE: F!; ISOTYPES: NY!, VEN).

Free-standing shrub to small tree, to 8 m tall; branchlets tetragonal, 5–7 mm diam, the angles acute to obtusish when dry, glabrous. Leaves petiolate; blades cartilaginous, elliptic, 4–7 cm long, 2.5–4(–4.5) cm wide, broadly rounded at summit, obtuse at base, not decurrent on the petiole,

symmetric, subnitid above, pallid and without round magenta glands below, midrib flat to slightly impressed above, prominently raised below, the secondary veins very inconspicuous, numerous, united by a very obscure submarginal connecting vein, the margin entire, scarious, opaque, glabrous; petioles broadly marginate, 6–15 mm long, glabrous. Staminate inflorescence a single, terminal, pendent flower; peduncle 8–15 mm long; subtended by two reduced leaves, the leaves coriaceous, obovate, 1.5–2.5 cm long, 1.5 cm wide, apex obtuse to rounded, base obtuse; bracteoles 2, cartilaginous, suborbicular, 3.5–4 mm long and wide, apex broadly rounded, carinate, the margin entire, opaque, not scarious, glabrous. Staminate flowers (immature bud) white, suffused with pink; sepals 4, decussate, stiffly coriaceous, the outer pair suborbicular, 6–7.5 mm long and wide, apex broadly rounded, linear latex canals numerous, conspicuous, the margin entire, opaque, not scarious, glabrous, the inner pair 5–6.5 mm long, 4.5–5.5 mm wide, apex broadly rounded, linear latex canals moderate, conspicuous, the margin entire, opaque, not scarious, glabrous; petals 6, the outer two opposite, cartilaginous, obovate to obovate-spathulate and somewhat clawed, 6–9 mm long, 3.5–5 mm wide, apex broadly rounded, cucullate, linear latex canals sparse, inconspicuous, the margin opaque, entire, not scarious, the inner 4 imbricate, like the outer ones but progressively smaller, to 4.5–5 mm long, 2.5–3 mm wide; androphore pentagonal; stamens numerous, ca. 3.5–4.5 mm long, the filament fleshy, flattened, ca. 2 mm long, broadly triangular and connivent at base, the anther linear, ca. 1.5–2 mm long, 0.3–0.5 mm wide, triangular in cross section, apically truncate, basally obtuse, fused with filament; pistillode obsolete. Pistillate flowers as in staminate, but peduncle 15–20 mm long; bracteoles 1.6–2 mm long; sepals cartilaginous, oblate, 8–10 mm long, 10–12 mm wide, apex broadly rounded, the margin scarious; persistent; petals cartilaginous, obovate-spathulate to somewhat clawed, apex broadly rounded, linear latex canals numerous, highly conspicuous, (12–)14–18 mm long, 0.6–0.8 mm wide; persistent in fruit; staminodes 9, rectangular in outline, flattened, 2.8–3.5 mm long, 1–1.5 mm wide, apex truncate, acute, with vestigial anthers; carpels 6(–8); styles 1–2 mm long; stigmas carnose, subpeltate, deltate, 3–3.5 mm long and wide in flower, 4.8–5 mm long and wide on mature fruit, ovules numerous, horizontal. Fruit ovoid, (2.5–)3–3.5 cm long, 1.5–2.5 cm diam.

*Distribution.*—Endemic to southern tepuis of Amazonas and Bolívar, Venezuela, at 1,400–1,800 m elevation.

*Ecology and conservation status.*—*Clusia hexacarpa* is common in *Clusia* scrub forests on outcrops and expose, steep slopes of tepuis, and as such, is not threatened. It is found with numerous Cyclanthaceae, at the junction of the scrub forests with seepage areas, such as the Bromeliaceae patches which

form colonies in poorly drained areas over rocks. It is not considered threatened or endangered.

Specimens examined: **VENEZUELA.** Amazonas: Cerro Aracamuni, summit, Proa Camp, 01°32'N, 65°49'W, 1,400 m, 26 Oct 1987 (pist. fl, fr), *R. Liesner & G. Carnevali* 22489 (MO, VEN), 28 Oct 1987 (fr), *R. Liesner & G. Carnevali* 22575 (MO, VEN); Cerro Huachamacari, Río Cunucunuma, Left fork, Caño De Dios, 1,800 m, 8 Dec 1950 (pist. fl), *B. Maguire* 30028, 30033, 30179 (NY, VEN), (stam. fl), *B. Maguire* 30029 (NY, VEN), Depto. Río Negro; Cerro de la Neblina, 6.5 km SSW of base camp, S extension of range, 00°47'N, 66°11'W, 1,600 m, 18 Apr 1984 (fr), *B. Stein et al.* 1651 (BRIT, MO, VEN); Cerro de la Neblina, S-face of Pico Phelps Massif, 00°48'N, 66°00'W, 1,550–1,650 m, 13 Apr 1984 (fr), *A. Gentry & B. Stein* 46596 (MO, VEN); escarpment above Camp IV, 1,650–1,750 m, 30 Dec 1953 (fr), *B. Maguire et al.* 36990 (NY, VEN), NW cumbre, 1,950 m, 30 Dec 1953 (pist. fl, fr), *Maguire et al.* 37003, 37022 (NY, VEN), vicinity Cumbre Camp, 1,800 m, 10 Jan 1954 (stam. fl), *B. Maguire et al.* 37144 (NY, VEN), NW Camp, 1,800 m, 12 Jan 1954 (fr), *B. Maguire et al.* 37247 (NY, VEN), trail immediately below N escarpment, 1,850 m, 17 Nov 1957 (stam. fl), *B. Maguire* 42132 (NY, VEN), escarpment above Cañon Grande, E of Cumbre Camp, 1,800 m, 22 Nov 1957 (pist. fl), *B. Maguire et al.* 42169 (NY, VEN), headwaters of Cañon Grande, SE portion, 1,900 m, 16–17 Oct 1970 (stam. fl), *J. Steyermark* 103973 (NY, VEN), (pist. fl), *J. Steyermark* 103975 (NY, VEN); Serranía Parú, Río Parú, Caño Asísa, SW escarpment, 1,850 m, 17 Dec 1950 (fr), *B. Maguire et al.* 33283 (NY, VEN), summit, W rim, 2,000 m, 2 Feb 1951 (fr), *R. Cowan & J. Wurdack* 31198 (NY, VEN); Serranía Yutajé, Río Maniapiare, NW ridge, 1,500 m, 23 Feb 1953 (fr), *B. & C. Maguire* 35393 (NY, VEN), 1,400 m, 1 Mar 1953 (fr), *B. & C. Maguire* 35419 (NY, VEN), Coro-Coro Drainage, 1,500 m, 2 Mar 1953 (fr), *B. & C. Maguire* 35500 (NY, VEN). Bolívar: Chimantá-Massif, Chimantá-tepuí, C section, above summit camp, 1,940 m, 4 Feb 1955 (stam. fl), *J. Steyermark & J. Wurdack* 412 (NY, VEN), bordering zanjón above summit camp, between Middle and Upper Falls of Río Tirica, 1,925–1,940 m, 4 Feb 1955 (pist. fl), *J. Steyermark & J. Wurdack* 592, 593 (NY, VEN), summit, along Caño Mojado, 1,985–1,910 m, 23 Feb 1955 (fr), *J. Steyermark & J. Wurdack* 1107 (NY, VEN); NW slopes of Churí-tepuí (Murú-tepuí), 25 Jan 1953 (pist. fl, fr), *J. Wurdack* 34198 (NY, VEN); Uaipán-tepuí, 1,900 m, 1–15 Feb 1948 (fr), *K. Phelps & C. B. Hitchcock* 394 (NY, VEN).

*Clusia hexacarpa* is closely related to *C. radiata*, but easily distinguished by the larger bracteoles, fewer sepals and petals, and most notably, the perianth persistent in fruit. The type of subsp. *ptaritepuiana* Steyermark is notable only for its rose markings on the petals and purple stigmas. In other species of *Clusia* I have seen in the field, stigmas are often more purple when exposed to the sun.

Maguire had intended to describe another subspecies of *C. hexacarpa*, bearing the subspecific epithet "*octocarpa*", and several specimens were distributed bearing that epithet. However, Maguire never published the name, and study of those specimens indicate that population differs from others only in having eight instead of six carpels. Many more specimens were available to me than were to Maguire, showing that floral merosity can change significantly even within populations.

8. *Clusia radiata* Maguire & Phelps, Bot. Soc. Venez. Cienc. Nat. 14. 1952.

TYPE. VENEZUELA. AMAZONAS: Cerro Guanay, SE escarpment, 1,800 m, 4 Feb 1953 (pist. fl, fr), B. Maguire, D. Phelps, C. B. Hitchcock & G. Budowski 31758 (HOLOTYPE: NY!; ISOTYPES: F!, VEN).

Free-standing shrub to small tree to 5 m tall. Branchlets tetragonal, 6–8 mm diam., the angles obtuse, not alate. Leaves petiolate; blades cartilaginous, widely obovate, widely elliptic to suborbicular, 6–10 cm long, 5–7 cm wide, apex and base widely rounded, base not decurrent on the petiole, symmetric, nitid above, pallid and without magenta glands below, midrib slightly elevated above, prominently elevated below, the secondary nerves barely distinguishable above, numerous, united by a submarginal collecting vein, linear latex canals inconspicuous, the margin entire, opaque, somewhat scarios, glabrous; petioles broadly marginate, 6–10 mm long, glabrous. Staminate inflorescence unknown. Pistillate inflorescence a single (rarely 3) terminal, pendent flower(s); peduncle angulate, 1.5–3 cm long, subtended by 2 small leaflike bracts 1.5–5 cm long, 1.2–3.5 cm wide; bracteoles 2, carnose, oblate, 12–14 mm long, 7–9 mm wide, apex broadly rounded, carinate, the margins entire, opaque, scarios. Pistillate flowers white; sepals 4, decussate, carnose, very widely ovate, 12–14 mm long, 7–9 mm wide, apex broadly rounded, linear latex canals inconspicuous, prominently carinate, the margin opaque, scarios, entire, glabrous; petals 8, cartilaginous, the outer and inner identical in shape, progressively smaller acropetally, the outer 4 decussate, the inner 4 imbricate, very widely obovate, 20–25 mm long, 16–20 mm wide, apex broadly rounded, linear latex canals few, moderately conspicuous, the margin entire, opaque, not scarios; staminodes numerous, 3.8–4 mm long, the filaments flat, 3–3.5 mm long, the anther linear, 0.3–0.5 mm long, apex truncate, base not distinguishable from filament, the connective darkened; pistil globose; carpels 7–10; styles minute, 0.8–1.0 mm long; stigmas carnose, cuneiform, subpeltate, 3–4 mm long and wide in fruit. Fruit ovoid, 3.5–4 cm long, 3.0–4.0 cm diam.

*Distribution.*—Endemic to Cerro Guanay, Amazonas, Venezuela, at 1,800–2,000 m elevation.

*Ecology and conservation status.*—*Clusia radiata* occurs on rocky outcrops along steep slopes. Cerro Guanay is a remote mountain and although nothing is known of the population biology of the species, it is likely that it is not threatened.

Representative specimen examined: VENEZUELA. Amazonas: Cerro Guanay, summit, 2,000 m, 4 Feb 1953 (fr), B. Maguire et al. 31749 (NY).

*Clusia radiata* is most closely related to *C. hexacarpa*, but is easily distinguished from it by the wider leaves, longer bracteoles, uniform and more numerous sepals, and more numerous petals.

**9. *Clusia maguireana* Pipoly, sp. nov. (Fig. 4)**

Quoad petiolos late marginatos, flores solitarios vel 3, fructum ovoideum, laminas cartilagineas *C. hexacarpae* valde affinis, sed ab ea petiolis obsolete vel 6 (non 6–15) mm longis, floribus 3–6 (nec 1–3), axillaribus (nec terminalibus), petalis suborbicularibus (nec orbicularibus vel obovatis) denique staminodiis 4 (non 8–9) praeclare distinguitur.

Shrub to small tree to 4(–10) m tall; branchlets tetragonal, strongly ridged but not winged, (4.5–)5–9 mm diam., glabrous. Leaves sessile; blades cartilaginous; very widely obovate, or rarely oblong, (3.5–)5–7(–10.2) cm long, (2.3–)3–5(–8) cm wide, apex rounded to truncate, base obtuse, not decurrent on the petiole, symmetric, nitid above, pallid and without magenta glands below, midrib raised above and below, secondary veins 20–30 pairs, not or barely visible, glabrous, w/o visible latex canals, the margin thick, opaque, revolute, entire, glabrous; petioles obsolete to 7 mm long, deeply canaliculate, ligulate, glabrous. Staminate inflorescence axillary, pendent, a twice-branched cyme, 2.5–3 cm long, the peduncle 5–7 mm long, the pedicels tetragonal, 5–7 mm long, glabrous; bracteoles 2, cartilaginous, suborbicular to oblate, 4–4.2 mm long, 4.5–4.7 mm wide, apex rounded, basally rugose, carinate, slightly cucullate, the margin entire, thick, opaque, glabrous; sepals 2, decussate to bracteoles, thinly coriaceous, oblate, 6.3–6.5 mm long, 7–7.2 mm wide, apex rounded, cucullate, the latex canals obscure, marginate, the margin chartaceous, ca. 0.7 mm wide, opaque, entire, glabrous; petals 4, decussate in pairs and to the sepals, thickly carnose, dimorphic, latex canals conspicuous the outer pair sublinguiculate, 5.2–5.9 mm long, the claw 0.7–1 mm long, 2.1 mm wide, the limb oblate, 4.5–4.9 mm long, 5.7–5.9 mm wide, apex broadly rounded, the margin thick, opaque, entire, glabrous, the inner pair unguiculate, 4–4.3 mm long, the claw 1–1.1 mm long, 1.3–1.4 mm wide, the limb oblate, 3–3.2 mm long, 3.5–3.7 mm wide, apex broadly rounded, the margin undifferentiated, opaque, entire, glabrous; receptacle convex, cubic, 1.6–1.8 mm high, 1.1–1.2 cm long and wide, without resin; androphore cubic, stamens 26, equal in size, free, 1–1.1 mm long, the filaments fleshy, flattened, free, 0.2–0.3 mm long, the anthers oblong, 0.9–1 mm long, ca. 0.5 mm wide, apex emarginate, base deeply cordate, the connective darkened, glabrous, longitudinally dehiscent over entire length; pistillode absent. Pistillate inflorescence pendent, a reduced cyme, 1.5–2(–2.5) cm long, the peduncle 2–3(–5) mm long, the pedicels tetragonal, 2–3 mm long, glabrous; bracteoles 2, cartilaginous, suborbicular to oblate, 2.1–2.2 mm long, 2.4–2.5 mm wide, apex obtuse, basally rugose, carinate, slightly cucullate, the margin entire, thick, opaque, glabrous; sepals 2, decussate to bracteoles, thinly coriaceous, orbicular, 6.4–6.6 mm long, and wide, apex rounded, cucullate, the latex canals obscure, marginate, the margin chartaceous, ca. 0.7 mm wide, opaque, entire or sparsely incised, glabrous; petals 4, decus-

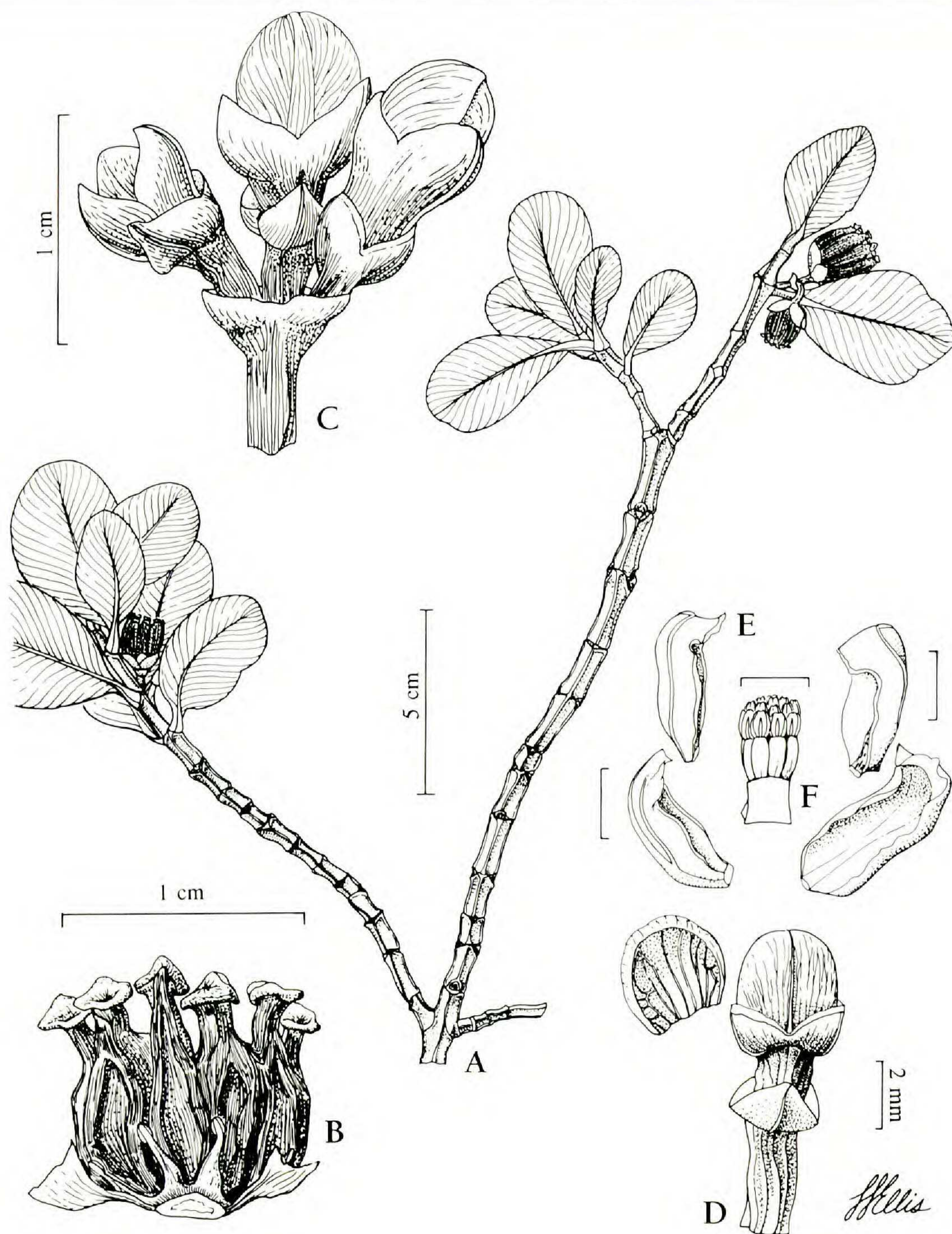


FIG. 4. *Clusia maguireana* Pipoly. Habit. B. Fruit. C. Pistillate cyme. D. Staminate pedicel, and separated sepal, showing scarios margin. E. Petals and androecium. A-C, drawn from type; D-E, drawn from *Steyermark* 93542.

sate in pairs and to the sepals, thickly carnose, dimorphic, latex canals conspicuous, the outer pair suborbicular, 4.5–4.9 mm long and wide, apex broadly rounded, the margin thick, opaque, entire, glabrous, the inner pair suborbicular, 4.2–4.3 mm long and wide, apex broadly rounded, the mar-

gin undifferentiated, opaque, entire, glabrous; staminodes 4, resembling stamens, 2–2.4 mm long, the filaments flattened, 1.4–1.6 mm long, broadly expanded at base, the sterile anthers orbicular, ca. 0.7 mm long and wide; pistil 10–carpellate, strongly ribbed, subglobose, 6–6.3 mm long, 5.6–5.8 mm diameter, styles obsolete, stigmas attached apically and basally, cuneiform, 2–2.1 mm long, 1.4–1.6 mm wide, persistent. Fruit subglobose, 1.7–2 cm long, 1.4–1.6 cm wide at maturity, strongly ribbed.

TYPE.: VENEZUELA. BOLÍVAR: Dtto. Piar, Macizo del Chimantá, sector N-central of Chimantá-tepuí, eastern headwaterscabeceras of Caño Chimantá, 5°18'N, 62°09'W, 2,000 m, 26–29 Jan 1983 (pist. fl, fr), *J. Steyermark* 127980 (HOLOTYPE: VEN; ISOTYPES: BRIT, F, MO-2 shts, US).

PARATYPES: VENEZUELA. BOLÍVAR: Saddle between Terekeyuren and Murisipan-tepuí, 1,650 m, 22 Mar. 1987 (fr), *B. Holst* 3469 (BRIT, MO, US, VEN); Dtto. Piar, central & W part of saddle between Camarcaibarai-tepuí and Tereké-Yurén-tepuí, 1,800–1,900 m, 05°52'N, 62°01'W, 23 May 1986 (fr) *R. Liesner et al.* 21006 (BRIT, MO, US, VEN); Auyán-tepuí, summit of central portion of NE arm (W range), between “Drizzly Camp” and “Río Lomita Camp,” 1,800–1,850 m, 5 May 1964 (pist. fl, fr), *J. A. Steyermark* 93442 (F, NY, US, VEN), same general area, woods beside small creek among savannas S of Jimmy Angel crash site, 1,800 m, 7 May 1964 (stam. fl), *J. A. Steyermark* 93542 (NY, US, VEN); central-NW section of E arm, Auyán-tepuí, 05°57'N, 62°25'W, 1,950 m, 27 Aug 1983 (stam. fl), *O. Huber et al.* 8096 (MYF, NY, VEN); Uei-tepuí, between SE slope and summit, between Luepa & Cerro Venamo, vic. of km. 125, S of El Dorado, 1,100–1,300 m, 7 Mar. 1962 (fr), *J. A. Steyermark & L. Aristeguieta* 20 (F, US, VEN); Macizo del Chimantá, Dtto. Piar, central-southern section, wide valley between NE border of Torono-tepuí and central section of Chimantá-tepuí, S drainage, 5°16'N, 62°09'W, 2,100 m, 11–15 Feb. 1985 (stam. bud), *J. Pipoly et al.* 7261 (MYF, NY, MO, VEN), (pist. fl, fr), *O. Huber, J. Pipoly et al.* 10171 (MYF, NY, VEN), (stam. fl), *O. Huber, J. Pipoly et al.* 10219 (MYF, NY, VEN); central-NW section of Chimantá-tepuí, E headwaters of Caño Chimantá, 05°18'N, 62°09'W, 2,000 m, 26–29 Jan 1983 (pist. fl, fr), *O. Huber & J. Steyermark* 6934 (MYF, NY, VEN), (pist. fl, fr), *J. Steyermark et al.* 127980 (NY, VEN); Abácapa-tepuí, *Bonnetia* forest, NW part of summit, 2,125–2,300 m, 13 Apr. 1953 (fr), *J. A. Steyermark* 74861 (F, US, VEN); Abácapa-tepuí, above 1st line sandstone bluffs, 2,000–2,125 m, 14 Apr. 1953 (fr), *J. A. Steyermark* 75002 (BRIT, F, MO, US, VEN); Apácara-tepuí, elfin forest formation on plateau of SE-facing upper shoulder of Apácara-tepuí, 2,000 m, 19 June 1953 (fr), *J. A. Steyermark* 75717 (F, NY, US, VEN); Agparaman-tepuí, SE-facing forested slopes below escarpment, 1,880–1,955 m, 26 Feb. 1955, *J. A. Steyermark & J. J. Wurdack* 1166 (pist. fl, fr), (F, NY, US, VEN). GUYANA. Potaro-Siparuni Region: Kaieteur National Park, N of Menzie's Landing, 05°N, 59°29'W, 400 m, 26 Jan 1987 (fr), *J. Pipoly & G. Gharbarran* 10029 (BRIT, BBS, CAY, FDG, K, NY, P, U, US); Pakaraima Mts., Mt. Wokumung, summit ridge of Kamiewah Pinnacle NE to S Pinnacle, “Little Ayanganna,” 05°04'N, 59°52'W, 1,550–1,650 m, 17 Nov 1993 (pist. fl), *T. Henkel et al.* 4495 (BRG, BRIT, US).

*Distribution.*—Endemic to the eastern tepuis of the state of Bolívar, Venezuela, and adjacent Guyana, at (400–)1,100–2,300 m elevation.

*Ecology and conservation status.*—*Clusia maguireana* is restricted to rocky outcrops, usually on overhanging ledges, and is subject to high winds and driving rains. I observed small patches of this species on the Kaieteur Plateau, but most of them were not fertile. It appears that the species has a

considerable range, and because it occurs in a very hostile habitat, it is most likely not threatened.

*Etymology*.—It is with great pleasure that I dedicate this species to the late Bassett Maguire, prodigious fieldworker, student of neotropical Clusiaceae and the flora of the Guayana Highland during his long career at the New York Botanical Garden. He conducted many expeditions to the most remote localities of the Guayana Highland, where he collected excellent specimens despite the harsh field conditions.

*Clusia maguireana* is most closely related to *Clusia hexacarpa*, but may be distinguished from it by the axillary inflorescence with greater number of flowers, the sessile leaves, suborbicular petals and fewer staminodes.

10. *Clusia opaca* Maguire, Bot. Mus. Leaflet. 15:62. 1951. TYPE: BRAZIL.

Amazonas: Path between headwaters of Ira-Igarapé and headwaters of Igarapé Abiú, affluent of Rio Taraira, 4–6 Jul 1948 (stam. fl), R. E. Schultes & F. López 10192 (HOLOTYPE: NY!; ISOTYPE: GH).

*Clusia reducta* Steyerl., Fieldiana, Bot. 28:391. 1952. syn. nov. TYPE: VENEZUELA.

Amazonas: Caño San Miguel, above mouth of Ichana, Guainía, 125 m, 26 Mar 1942 (pist. fl, fr), L. Williams 14898 (HOLOTYPE: F!; ISOTYPE: US!).

Free-standing shrub to tree 6 m tall; branchlets subterete, 3–4 mm diam., sparsely longitudinally ribbed, glabrous. Leaves petiolate; thickly coriaceous, oblong or elliptic, (4.5–)7–9 cm long, 2.5–3.5(–5) cm wide, apex and base broadly rounded, the base not decurrent on the petiole, symmetric, nitid above, pallid and without magenta glands below, midrib impressed above, prominently raised below, the secondary veins numerous, inconspicuous, united by a submarginal nerve, linear latex canals inconspicuous, the margin revolute, entire, glabrous; petiole canaliculate, (0.6–)1–1.5 cm long, glabrous. Staminate inflorescence terminal, pendent, a compact compound cyme, 6–18-flowered, 1.5–2 cm long, and wide; subtended by a pair of leaflike bracts, 1.5–4 mm long, 0.7–1.2 cm wide, apex broadly rounded, base obtuse, the margins revolute, entire; peduncle ca. 3 mm long, subterete, glabrous; bracts carinose, oblate, 1.8–2.2 mm long, 2–2.4 mm wide, apex rounded, carinate, the margin entire, opaque, not scarious, glabrous; bracteoles 4, decussate, oblate, carinose, 1.8–2.2 mm long, 2–2.5 mm wide, apex obtuse, carinate, the margin entire, opaque, scarious, glabrous; pedicels angulate, 3–7 mm long, glabrous. Staminate flowers white; sepals 4–5(–6), the outer opposite, decussate to the bracts, membranaceous, orbicular, 3–5 mm long, and wide, apex broadly rounded, linear latex canals few, conspicuous, the margin entire, hyaline, scarious, glabrous, the inner ones imbricate, 3.8–4.2 mm long and wide, apex broadly rounded, the margin entire, hyaline, scarious; petals 4–5, coriaceous, oblong, the outer ones opposite, the inner imbricate, all similar in shape, acropetally decreasing in size, 4–6 mm long, 3.8–4.5 mm wide, apex broadly rounded,



cucullate, the linear latex canals obscure, margins entire, opaque, not scarious, glabrous; androphore pentagonoid, concave; stamens numerous, 0.9–1.5 mm long, the filaments flattened, connate basally, the distal ones 0.2–0.3 mm long, the interior 0.5–0.7 mm long, the anthers linear, oblong, 0.7–1 mm long, 0.2–0.3 mm wide, apex rounded, base obtuse; pistillode obsolete, not resiniferous. Pistillate inflorescence as in staminate, but bracteoles 2–2.5 mm long, 2.3–2.5 mm wide. Pistillate flowers as in staminate, but sepals 4–6, 4–4.5 mm long, 4.5–5 mm wide, petals 4–5 mm long, 3.3–4 mm wide; staminodia numerous, 0.8–1.2 mm long; filaments flat, linear, anthers barely differentiated, ca. 0.2 mm long, apex rounded, base not differentiated; pistil subglobose, 3–5 mm long and wide; carpels 5; styles subobsolete; stigmas sessile, orbicular, ca. 1 mm diam., ovules numerous. Fruit globose, 1.2–1.5 cm long and in diam.

*Distribution.*—Western Amazon Basin of Brazil, Venezuela and Colombia, at 80–160 m elevation.

*Ecology and conservation status.*—*Clusia opaca* is endemic to “Amazonian caatinga,” campinas, and “Bana” formations, all of which are lowland subxeric areas of deep white sands, often near black water rivers, but not subject to inundation (Macedo & Prance 1978; Prance 1979; Prance & Schubart 1978). These environments all share essentially the same nutrient cycling regime, and vary only in terms of local species composition. The white sands are coarse in texture, extremely well-drained, and derived from eroded tepuis. *Clusia opaca* is locally common, and because it occurs near the major black water rivers of the Amazon Basin, which support relatively heavy river traffic, it should be considered threatened.

*Common names.*—“Pai-nan-ge” (Brazil, Makú language); “copei,” “upihi,” “baniha,” “cupi” (Venezuela).

Specimens examined: **COLOMBIA.** Caquetá: Araracuara, sandstone plateau behind military camp, 00°37'S, 72°24'W, 18 Oct 1990 (fr), *J. Duivenvoorden & A. Cleef* 314 (BRIT, COL, U). **VENEZUELA.** Depto. Atabapo: SE bank of the middle part of Caño Yagua at Cucurital de Yagua, 03°36'N, 66°34'W, 120 m, 8 May 1979 (fr), *G. Davidse et al.* 17361 (MO, MYF, NY, VEN); El Almidón, limit of Depts. of Atabapo and Casiquiare, Río Atacavi, slope 2, 03°04'N, 67°06'W, 80 m, Nov 1989 (fr), *J. Velasco* 869 (BRIT, PORT, VEN); Near San Antonio, Alto Orinoco, along Río Orinoco, 120 m, 15 Aug 1982 (pist. fl), *T. Ruiz et al.* 3964 (MY, VEN); Río Guainía, 14 Apr 1953 (pist. fl), *B. Maguire & J. Wurdack* 35642 (F, MO, NY, US, VEN); savanna 5 km E of Maroa, 130 m, 6 Oct 1957 (stam. fl), *B. Maguire et al.* 41705 (F, NY, US, VEN), (pist. fl bud), *B. Maguire et al.* 41706 (F, NY, US, VEN) Maroa-Yavita road, between Río Guainía and Caño Pimichín, ca. 2 km beyond Maroa airport, 02°43'N, 67°38'W, 8 Oct 1978 (pist. fl, fr), *H. Clark* 6863 (MO, NY, US, VEN); Maroa, Río Guainía, 127 m, 1942 (fr), *Ll. Williams* 14254 (F, US); Pimichín, 128 m, 2 Jul 1942 (fr), *Ll. Williams* 14183 (F, US); savanna 0.5–1.5 km N of Puerto Colombia, opposite Maroa, Colombia, 130 m, 12 Oct 1957 (fr), *B. Maguire et al.* 41843 (F, NY, VEN); Depto. Casiquiare, Río Casiquiare, 40 km beyond the mouth and 5 km NE of camp, 28 Jan 1991 (fr), *M. Colella et al.* 1610 (BRIT, NY, VEN); Río Casiquiare, 162 kms

from the mouth, 3 Feb 1991 (fr), *M. Colella et al.* 1752 (BRIT, NY, VEN)[mixed collection with *C. gaudichaudii* Choisy ex Pl. & Tr]; Caño San Miguel, sector "Las Tinajas," 02°39'N, 66°45'W, 160 m, 25 Apr 1991 (fr), *G. Aymard* 9237 (BRIT, PORT, VEN).

*Clusia opaca* is most closely related to *C. guayanae*, but easily distinguished by the obtuse to broadly rounded leaf bases, the shorter peduncle, suborbicular sepals, coriaceous petals, numerous staminodes and sessile, orbicular stigmas.

### 11. *Clusia guayanae* Pipoly, sp. nov. (Fig. 1)

Species haec quoad petiolos canaliculatos, flores 6–18 in cyma insidens, fructus globosum, laevem, non costatoque, *C. opacae* valde arcte affinis, sed ab ea laminis ad basem obtusis vel late rotundatis (non acutis vel obtusis), pedunculis 5–12 (non 3–5) mm longis, sepalis 2 (non 4–6), oblatis (nec suborbicularibus), petalis cartilagineis (non coriaceis), staminodiis 4 (non numerosis), denique stigmatibus pentagonis (non orbicularibus) perspicue recedit.

Shrub to 2 m; branchlets tetragonal, 3.5–5 mm diam., glabrous; latex white. Leaves petiolate; blades coriaceous, oblanceolate to obovate or rarely suborbicular, (3–)4–6(–7) cm long, (1.5–)2–3.5(–4) cm wide, obtuse to truncate, base obtuse to rounded, nitid above, pallid and without magenta glands below, glabrous, midrib slightly raised above, prominently raised below, secondary veins numerous, at a steep angle from midrib to a large submarginal collecting vein, ca. 0.3 mm from margin; petiole canaliculate, 3–5 mm long, with a deep channel at base. Staminate inflorescence terminal, a pendent panicle, 2–3 cm long, 2–3 cm wide, the branches cymose, in sets of 3; peduncle squarrose 5–8(–12) mm long; secondary branch bracts 2, carnosae, depressed ovate, 1.8–2 mm long, 2.1–3 mm wide, apex broadly rounded, glabrous, margins entire, opaque; bracteoles 4, decussate, carnosae, depressed ovate, 2.2–2.4 mm long, 2.6–2.8 mm wide, apex broadly rounded, glabrous, margins entire, opaque; sepals 6, coriaceous, decussate, the outer 2, depressed-ovate cucullate, carinate, 4–4.5 mm long, 5–5.5 mm wide, apex broadly rounded, margins entire, opaque, glabrous, the inner ones oblong, cucullate, 5–5.3 mm long, 4–4.5 mm wide, apex truncate to widely rounded, the margin scarious, entire; petals 4, cartilaginous, oblong to widely oblong, cucullate, apex obtuse to truncate, 3.5–5 mm long, 2–3 mm wide, margin irregular, opaque, thick; androphore concave, quadrate, 0.8–1 mm long, 1.4–1.6 mm diam.; stamens 8, oblong, muticous, filaments and anthers undifferentiated, 0.8–1 mm long, 0.3–0.4 mm wide, apex rounded; pistillode absent. Pistillate inflorescence as in staminate, but 1.5–2 cm long, 1.5 cm wide, secondary branch bracts 2, as in staminate; bracteoles 4, decussate, as in staminate flowers; sepals 6, decussate, depressed ovate, the outer ones sepals 3.8–4 mm long, 4.2–4.5 mm wide, inner ones 4.8–5 mm long, 4–4.2 mm wide, coriaceous, cucullate, carinate, apex broadly rounded, the margin scarious; petals deep pink, 4–5,

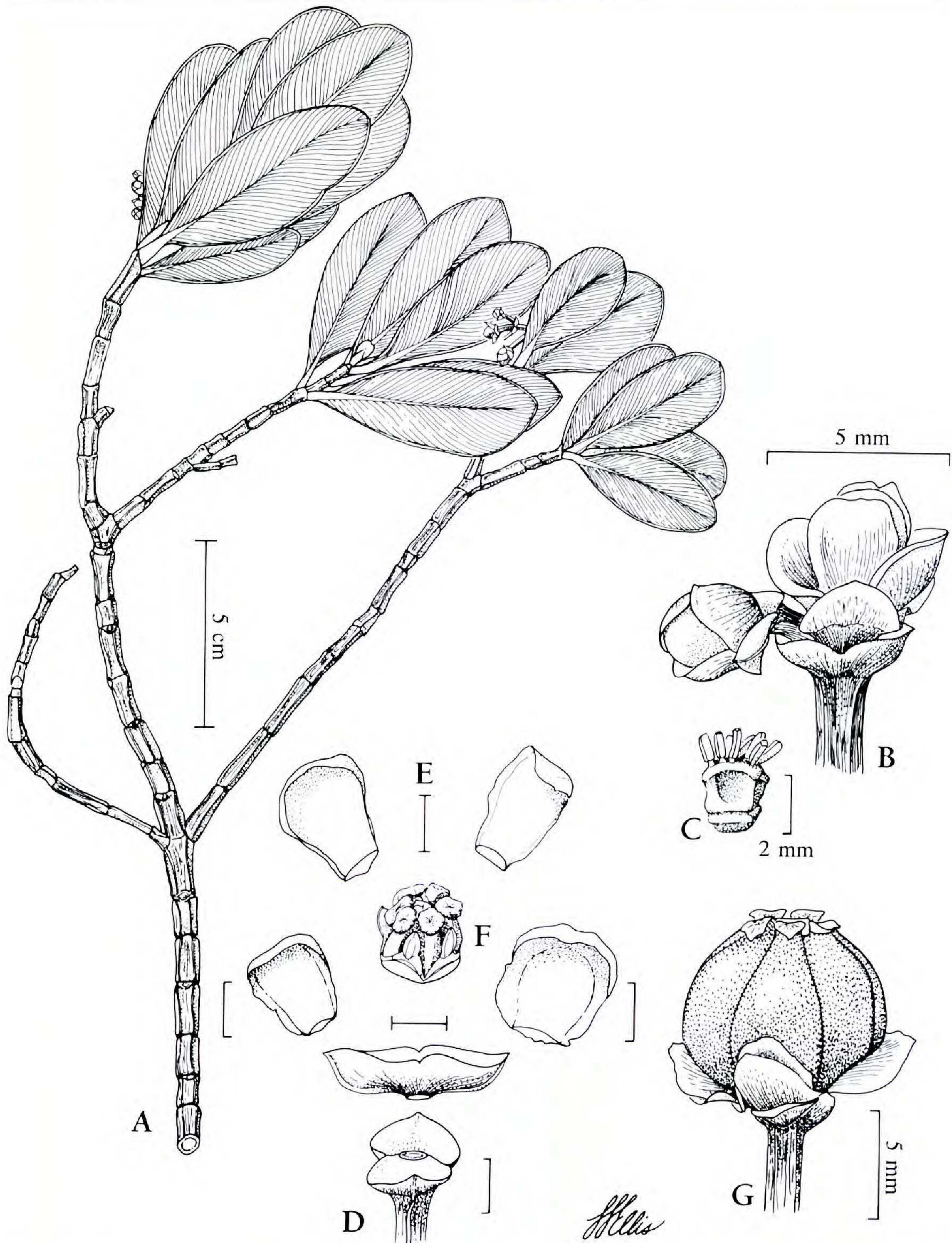


FIG. 5. *Clusia guayanae* Pipoly. A. Habit. B. Immature inflorescence. C. Androphore and androecium. D. Bracts and sepals. E. Corolla. F. Staminodia and ovary. G. Fruit. A-C, drawn from Steyermark & Holst 20984; D-G, drawn from Huber 9330.

cartilaginous, oblong, 5–7 mm long, 2–3 mm wide, cucullate, apex broadly rounded; staminodes 4, 1.8–2.2 mm long, thin, strap-like, bases united by a flat tube 0.2 mm long, the filaments 1–1.2 mm long, broadly ovate, the

anthers widely oblong, 0.8–1 mm long, 0.6–0.8 mm wide, apex muticous, with narrow longitudinal slits; pistil 5-carpellate, subglobose, 2.7–3 mm long and diam., the stigmas peltate, sessile, pentagonal. Fruit depressed-globose, 0.8–1 cm long, 1–1.2 cm diam., pinkish yellow.

TYPE. GUYANA. CUYUNI-MAZARUNI REGION: Mt. Ayanganna, E side on steep slopes, 5°27'N, 59°57'W, 1,250–1,300 m, 12 Mar 1987 (pist. fl), J. Pipoly, G. Gharbarran, G. Samuels, J. Chin 11162 (HOLOTYPE: FDG; ISOTYPES: BRIT, NY, US.).

PARATYPES. VENEZUELA. BOLÍVAR: Dtto. Heres; Macizo del Guaiquinima, central-NE section, slope draining S; 5°54'N, 63°42'W; 1,350 m, 1 Apr. 1984 (pist. fl, fr), O. Huber 9330 (MYF, NY, VEN); Dtto. Piar, Central and western part of saddle between Camarcaibarai-tepuí and Tereké-Yurén-tepuí, 05°52'N, 62°01'W, 1,800–1,900 m, 23 May 1986 (stam. fl), R. Liesner, et al. 20984 (MO, US, VEN); Camarcaibarai-tepuí, shoulder of W slope, easternmost tepuí of Aparamán-tepuí range, 05°52'N, 62°01'W, 1,800 m, 24 May 1986 (pist. fl, fr), B. Holst et al. 2887 (MO, VEN); Auyán-tepuí, summit, south-central region, headwaters of Río Churún, 05°51'N, 62°32'W, 1,700 m, 29 Mar 1987 (fr), B. Holst 3738 (MO, VEN); plain in westernmost section of W arm of Auyán-tepuí, 25 km SE of Canaima, 06°06'N, 62°43'W, 1,650 m, 13 Nov 1984 (stam. fl), O. Huber 9728 (MYF, NY, VEN).

*Distribution.*—Endemic to the easternmost tepuis of Bolívar state, Venezuela, and their satellites, at 1,250–1,900 m.

*Ecology and conservation status.*—*Clusia guayanae* occurs in low, scrub cloudforest formations along edges of sandstone bluffs, dominated by *Clusia melchiorii*, *Clusia crassifolia* Planch. & Triana, *Bonnetia* spp., numerous Myrtaceae and Rubiaceae. Its habitat has a hostile climate, with strong winds and rains. Because this species appears to inhabit the most inhospitable of climates, it is not considered threatened.

*Etymology.*—The specific epithet, “guayanae” is in the Latin locative, for this member of the autochthonous flora of the Guayana Highland.

With canaliculate petioles, flowers in 6–18-flowered cymes, and smooth, globose fruits without ribs, *C. guayanae* is most closely related to *C. opaca*. However, *C. guayanae* is easily separated from *C. opaca* by the broadly acute to obtuse leaf bases, longer peduncle, fewer, oblate sepals, cartilaginous petals, 4 staminodes and pentagonal stigmas on styles.

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## NUMERICAL LIST OF TAXA

- |   |   |
|---|---|
| 1. <i>Clusia duidae</i> Gleason         | 7. <i>Clusia hexacarpa</i> Gleason        |
| 2. <i>Clusia grammadenioides</i> Pipoly | 8. <i>Clusia radiata</i> Maguire & Phelps |
| 3. <i>Clusia multilineata</i> Pipoly    | 9. <i>Clusia maguireana</i> Pipoly        |
| 4. <i>Clusia asymmetrica</i> Pipoly     | 10. <i>Clusia opaca</i> Maguire           |
| 5. <i>Clusia melchiorii</i> Gleason     | 11. <i>Clusia guayanae</i> Pipoly         |
| 6. <i>Clusia cardonae</i> Maguire       |   |

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al. 10171 (9); 10219 (9). Huber, O. & L. Hernández 11721 (6). Huber, O. & J. Steyermark 6934 (9).

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